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CONTENTS

MATHEMATICS AND STATISTICS. By Edwin B. Wilson 1

DIFFERENTIAL FERTILITY ACCORDING TO SOCIAL CLASS. By Edgar Sydenstricker and Frank W. Notestein 9

A MISTAKEN CONCEPTION OF THE CENTER OF POPULATION. By Walter Crosby Eells 33

EFFECT OF CONCENTRATION OF INDUSTRY ON SEASONAL VARIATION OF EMPLOYMENT. By Amy G. Maher 41

WAGES OF DOMESTIC LABOR IN CHICAGO, 1890–1929. By Alice C. Hanson and Paul H. Douglas 47

STOCK PRICE INDEXES OF THE NEW YORK CURB EXCHANGE. By Leonard Kuvin 51

THE "IDEAL" FORMULA FOR "GENERAL PURPOSE" INDEX NUMBERS. By F. Gardiner Perry and A. G. Silverman 63

NOTES:

The Eighteenth Biennial Session of the International Statistical Institute. By Walter F. Willcox 69

The Simplest Symmetrical Expression for Rate of Change of Time Series Data. By Max Sasuly 72

Relation Between the Arithmetic and Geometric Average of Two Index Numbers. By R. von Huhn 76

Concentration of Statistical Services in Italy. By G. Zabiello ... 80

The Importance of an Index of Specific Relative Growth of Industries (82); Comment on "The Variate Difference Method of Seasonal Variation" (83); A Reply to Dr. Lotka's Review of "The Balance of Births and Deaths" (84); Rejoinder (85); Bank Mergers (86); Progress of the Census (90); Miscellaneous Notes (93); Members Added (101).

REVIEWS 104

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MATHEMATICS AND STATISTICS. By EDWIN B. WILSON 1

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WAGES OF DOMESTIC LABOR IN CHICAGO, 1890–1929. By ALICE C. HANSON and PAUL H. DOUGLAS 47

STOCK PRICE INDEXES OF THE NEW YORK CURB EXCHANGE. By LEONARD KUVIN 51

THE "IDEAL" FORMULA FOR "GENERAL PURPOSE" INDEX NUMBERS. By F. GARDINER PERRY and A. G. SILVERMAN 63

NOTES:

THE EIGHTEENTH BIENNIAL SESSION OF THE INTERNATIONAL STATISTICAL INSTITUTE. By WALTER F. WILLCOX 69

THE SIMPLEST SYMMETRICAL EXPRESSION FOR RATE OF CHANGE OF TIME SERIES DATA. By MAX SASULY 72

RELATION BETWEEN THE ARITHMETIC AND GEOMETRIC AVERAGE OF TWO INDEX NUMBERS. By R. VON HUHN 76

CONCENTRATION OF STATISTICAL SERVICES IN ITALY. By G. ZABIELLO 80

THE IMPORTANCE OF AN INDEX OF SPECIFIC RELATIVE GROWTH OF INDUSTRIES (82); COMMENT ON "THE VARIATE DIFFERENCE METHOD OF SEASONAL VARIATION" (83); A REPLY TO DR. LOTKA'S REVIEW OF "THE BALANCE OF BIRTHS AND DEATHS" (84); REJOINDER (85); BANK MERGERS (86); PROGRESS OF THE CENSUS (90); MISCELLANEOUS NOTES (93); MEMBERS ADDED (101).

REVIEWS: National Bureau of Economic Research: *Recent Economic Changes in the United States*, by A. Marget (104); Kelley: *Crossroads in the Mind of Man*, by C. Spearman (107); Bennett: *Farm Cost Studies in the United States*, by J. Viner (111); Walker: *Studies in the History of Statistical Method*, by J. R. Miner (113); Carroll: *Unemployment Insurance in Germany*, by Amy Hewes (114); Rowe: *Wages in Practice and Theory*, by P. H. Douglas (117); Mlynarski: *Gold and Central Banks*, by R. Warren (118); Lovitt and Holtzclaw: *Statistics*, by H. L. Rietz (119); *The Labor Banking Movement in the United States*, by J. G. Rolph (120); National Industrial Conference Board: *The Cost of Living in Twelve Industrial Cities*, by M. Leven (122); Heller Committee: *The Dependent Aged in San Francisco*, by I. M. Rubinow (123); Bauer: *Mathematics Preparatory to Statistics and Finance*; Schmidt: *Mechanics of Accounting*, by R. von Huhn (125); Schnackel and Lang: *Accounting by Machine Methods*, by T. O. Yntema (126); Snider: *Business Statistics*, by H. V. Roelse (126); Woodward: *Profits in Insurance Stocks in America*; Williams: *Investment Trusts in America*, by H. K. Herwitz (128).

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MATHEMATICS AND STATISTICS[1]

By Edwin B. Wilson

It is, I believe, the custom for the President, avoiding technicalities in his address, to give the Association some general point of view upon that particular branch of theoretical or applied statistics upon which he may consider himself reasonably competent to advise. It has seemed to me well to discuss the relation of mathematics to statistics, partly because so many persons behave as though a great deal of mathematical background were essential to a safe and satisfactory practice of statistics and partly because so many others behave in the directly contrary way as though no mathematics at all were necessary and much were harmful. In treating a topic on which behavior is so varied and opinions presumably even more at variance, it must be apparent that I am taking my life in my hands and that if I survive at all it can only be with fewer friends and more enemies.

Mathematics may be either right or wrong. By this I mean that when you add 2 and 5 together you may get 7, which is right, or something else such as -3, which is wrong.

Or, to take a more complicated illustration, if you decide to fit some empirical formula or curve to a set of coördinate data, such as prices and times or populations and times, you may proceed in several ways. First, you may plot the variables and draw in the curve according to your aesthetic sense. A curve so fitted cannot be either right or wrong, but only a matter of taste. There is no way in which the work can be checked. Of course a dozen persons may be given the same sequence of points and be required each to fit the curve according to his taste; the results of those different fittings may then be compared to determine how much and in what way the solutions differ. I am

[1] Presidential address at the Ninety-first Annual Meeting of the American Statistical Association, Washington, December 28, 1929.

not averse to this aesthetic procedure. When the curve to be fitted is a straight line, it has been found by experiment that the solutions obtained do not, on the average, depart from the "least squares" solution by more than two or three times the probable error of the least squares solution, provided the drawing be made on an adequate scale. In cases where it is not important to check the work and where the precise least squares solution is unnecessary, the graphical method is often the best because the easiest to follow.

There are persons, however, who like to go through the work or force their assistants through the work of a least squares solution even when it is not necessary. And of course there are many cases in which to avoid the work of a least squares solution would be to shirk. One great advantage of such a solution is that it can be checked, it is either right or wrong. Every person who does the work correctly, starting with the same set of data, with the same weights assigned to each point, and with the same empirical formula to fit, should get the same answer to that degree of arithmetic accuracy which is justified by the number of places carried in the calculation and without any regard to whether the original data justify carrying so many arithmetic places or not. It is a matter of taste whether one determines to apply least squares; it is also a matter of taste whether he assigns one set of weights or another to the various points, and it is often a matter of taste whether he selects one or another type of empirical formula to be fitted; but once this is all determined, the answer is right or wrong just as $2+5=7$ is right and $2+5=-3$ is wrong —or better, as $\sqrt{2}=1.414$ is right (to four places) and $\sqrt{2}=1.305$ is wrong (even to two places).

Although mathematics may be right or wrong, I believe it is fair to claim that it should be right. It is difficult to undertake to prove that mathematics should be right. We are here dealing with a question of ethics, not with one of science. We do not expect an artist to be right or wrong; we could hardly accuse a metaphysician of being either right or wrong. The criteria of excellence of performance in all such cases must be based on tastes—the tastes of the performers and of their critics, and, according to the old maxim, "de gustibus non est disputandum," albeit I know of nothing about which there is so much dispute as tastes, and for obvious reasons, which may account for the necessity of the maxim. The reason that mathematics should be right is because it can be; and for this reason, to avoid disputes, it has become the professional ethics of those who apply mathematics to get that part of their work right. So widespread is this ethics that in practice one rarely tries to check the

purely mathematical work of an investigator. It is not that the principle of corroboration which pertains to all scientific investigation is in abeyance, but merely that the mathematician is expected to check, *i. e.*, to corroborate his own work so that the reader may take it on faith. Let us borrow the terminology of our societologists and say that it is in the folkways and mores of mathematicians that their mathematics should be right. Let us treat it as an axiom.

Why, then, should I make so much of the matter? Precisely because there are so many persons now using mathematics for the first generation in their respective sciences that it is advisable to set out what is the professional ethics of applied mathematicians. And because I regret to say that I have come across work by well-known investigators, in famous institutions, financed by generous foundations, work printed in journals of international repute, but unhappily so far from right that its wrongness can be recognized at a glance by any one really familiar with mathematical procedures. Evidently the work could not have been checked by the authors as it should have been or really read by an intelligent editor. This kind of writing and editing is a real imposition on the reader and necessitates some emphasis upon the duty of him who uses mathematics to get it right. Of course, we must not be too severe, accidents will happen and in any particular case it comes down to a matter of judgment as to whether negligence has been criminal.

Mathematics, assumed now to be right, may be appropriate or inappropriate to the problem in hand. This appropriateness is again very largely a matter of taste. One great advantage to the investigator of being familiar with a considerable variety of techniques and of the mathematical background of those techniques is that he has a greater experience and a sounder knowledge as a basis for his judgment as to appropriateness and is therefore likely to have better taste in such matters. I made mention of the method of least squares. I wonder how many of you realize how pervasively that method penetrates our statistical procedures even when it does not appear on the surface. Suppose we add a column of figures and find the mean. Do we stop to think that the mean is the least squares solution of the problem of finding one item to represent the whole group? The mean is nearest to all the elements of the group only if we take as the criterion of nearness the square of the eccentric departure and not the departure itself. It is the median which we should use if our notion of nearness is to be founded on the departure instead of on its square, and I may recall to your mind that the great economist and statistician, F. Y. Edgeworth, had a considerable partiality for medians

—I know not why, perhaps merely as a matter of personal taste. Fortunately for many if not most problems, conclusions based on working with medians or with means are for practical purposes identical, but when they differ one may well hesitate.

To discuss a little this question of appropriateness of mathematics, let us take the purely hypothetical question: Where should our Association meet? How might a scientific member from among us solve this problem? As to this I have no idea, the ways of scientists are often inscrutable. One type of mind would doubtless construct a spot map of our membership scattered as it is about the country. If very conscientious, he would recall that many who are not our members but belong in associations which use statistics should perhaps be given some consideration, and he might therefore add to his spot map with somewhat reduced weights points to represent them. But how then select our meeting place? Should he determine the center of gravity of all these points? Some would do so automatically. They would be in fact maintaining that the best point to meet would be that which minimized the sum of the squares of the railroad fares that would be paid by all persons if all attended. And others might reason that what we needed was the point of greatest concentration of our population on the ground that it would be of maximum convenience to the greatest number—a just procedure provided not many would come from a distance anyhow. This would be selecting the mode. Still others might feel that all interests were best met by that point which would make the sum of the railroad fares least, being in that median sense the point nearest to the whole membership and thus presumably most convenient on the whole. It is clear that the scientific solution could be obtained only after determining that type of mathematical formulation which was most appropriate to the problem, and this determination would be a matter of taste.

Fortunately, we all know that we may be spared such a scientific determination of the place where we shall meet. Like as not, nobody would be satisfied with the solution anyway and at all events there would be years of dispute over the appropriateness of any methodology. Much more practical means suffice. The Economic Association determines willy-nilly to come to Washington; the Political Scientists feel an irresistible urge to celebrate their 25th anniversary at New Orleans, and the rest of us decide where we will go only after much discussion and perchance with small rational basis. This is one of those cases where pretty much all mathematics is inappropriate, where any mathematics whatsoever will give an entirely false sense of precision to a problem in which no precision inheres. And

there are many problems in economics or sociology or the public health which are as yet very much in the same position and where we need not so much some kind of mathematics or some particular statistical technique as a general survey of a wide range of facts, many of them qualitative rather than quantitative, which may serve as a basis for some decision.

Probably the majority of problems to which the statistician must turn his attention are in reality somewhat intermediate between those in which the technique to be applied is clear and those in which no technique, at least of a mathematical sort, is advisable. In this methodological no-man's land, the statistician must do the best he can. He may have to develop a new technique; in that case he has two chief reliances, first and foremost a sound and wide acquaintance with the field of activity in which he has to operate, and second a good mathematical background, because it is from that that all techniques are developed; but if choice must be made between familiarity with his subject and familiarity with mathematics, I should unhesitatingly prefer the former. Mathematics is a queer horse and all too easily runs away with its rider; and then there is such a satisfaction in trying its various gaits in all sorts of roads that many a rider has gone off in almost the opposite direction from the path he should have followed in his pursuit of the solution to some scientific problem; he may have ridden right over his solution to some purely fantastic goal.

Each person has to do the best he can to bring to bear upon his work the talents and the training that he has. If I may be pardoned a personal confession, I will say that I have never been sorry that in my youth I acquired an unusually good acquaintance with mathematics. At times when engaged upon some statistical problem in physics, I have needed to learn new mathematics, but for the most part my early training has sufficed not only to let me follow the mathematics of others but, so to speak, to see through it with an assurance which sometimes has convinced me that it was hollow. And if in my present studies I use but little of the vast amount I have once learned, it is not because I do not like the exercise of using it but because I prefer tools more appropriate to my job even though not so refined—one gets ahead faster.

Mathematics may be right or wrong, it may be appropriate or inappropriate, it may be useful or useless. There is many a useless problem. Sometimes one cannot see it is useless until much time has been spent upon it. But consider this: I have a field in New Hampshire much covered with stones, rocks, and boulders. With sufficient

energy I could weigh all those objects, divide the weights into suitable intervals, plot a histogram, and fit a frequency function. That would be scientific observation, followed by mathematical treatment of the observations. The problem is obviously statistical. It would keep me occupied for some time. But what would be the use? Of course if I knew enough about geology to be confident that my field was a fair sample of a large group of fields and if there was any geological or agricultural or constructional or other interest to be served in determining a frequency function of the weight of superficial stones from small to large from a "sample" field the job might not be useless but useful. But there seems at present no good purpose to be served by its doing. And often I wonder in some of my reading whether the hard work the author has done, though correct and appropriate in its mathematics, may not be quite useless.

What we need to foster is useful, appropriate, correct mathematics applied to worth-while scientific problems, and worth-while scientific problems whether or not they have reached the stage where any considerable use of mathematics is helpful. And in these vital matters, we have far more need of good taste and a sure instinct than is commonly believed; for it is so often only in the future that we can get a statistical estimate of the worth-whileness of present activities. Happy is the statistical investigator who can use all his techniques with discretion, and happy the teacher who can give his students some sense of proportion as well as a group of methods in such a conglomerate field as statistics.

Placed as I was upon the program between sociology and economics, represented by such giants as Presidents Ogburn and Gay, interested the one in making himself a mental centrifuge to precipitate the facts of recent social change from that murky colloidal solution we call the present, the other bent on crystallizing out from the sub-cooled liquor of our past the solid course of prices, it was quite impossible for me to determine whether I was to be the meat of your sandwich or the comic relief of your tragedy. Without pausing now to suggest an answer to this question, but rather in the continuing line of my previous remarks, may I direct your attention to that interesting statistical treatise *The Bridge of San Luis Rey*, by Thornton Wilder. Some of you recall the story. The bridge fell, killing five persons, and the devout Brother Juniper was struck by the question: Why did this happen to those five? And determined to surprise the reason of their taking off. It seemed to him that it was high time for theology to take its place among the exact sciences and he had long intended putting it there. What he had lacked was an opportunity for obser-

vation under *proper control.* Previous happenings had been involved, but here was a sheer Act of God and at last His intentions could be studied in a pure state. It was not, however, Brother Juniper's first essay in scientifically examining the ways of God to man. There had been a deadly pestilence of small-pox in his village and he had recently drawn up a diagram of the characteristics of fifteen victims and fifteen survivors, the statistics of their value *sub specie aeternitatis.* Each soul was rated upon a basis of ten as regards its goodness, its piety and its usefulness to its family group. As follows:

	Goodness	*Piety*	*Usefulness*
Alfonzo G.	4	4	10
Nina	2	5	10
Manuel B.	10	10	0
Alfonzo V.	−8	−10	10
Vera N.	0	10	10

The investigation developed difficulties; almost every soul in this little community turned out to be economically indispensable and the column headed "Usefulness" was all but useless; negative signs had to be introduced to distinguish from the good and bad those who were not only wholly bad (Grade 0) in and of themselves but actively led others into wickedness. From all this data the good scientific friar contrived an index for each person. He added up the total for the victims and compared it with the total for survivors—to discover that the dead were five times more worth saving. And then, taking a walk by the Pacific he tore up his findings and cast them into the ocean—a most profitable mode of publication and in a medium of the widest circulation.

So when he came to study his one great chance, the collapse of the bridge with its five victims, having experienced the bitter disappointments of statistical procedure, Brother Juniper forsook the method of W. F. Ogburn, for that of W. I. Thomas—the case study. In compiling his book on these five victims he omitted no slightest detail for fear he might lose some guiding hint. He put everything down in the hope that the countless facts would suddenly start to move, to assemble, and to betray their secret. Of one, the Marquesa de Montemayor, he learned from her cook that she had lived almost entirely on rice, fish, and a little fruit, and he put it down on the chance that it would some day reveal a spiritual trait to aid in sifting the inscrutable ways of God. From another, he learned that she came unbidden to his receptions to steal the spoons. A bookseller testified that she was one of the three most cultivated persons in town. The midwife declared that she had called upon her with morbid ques-

tions until she became a nuisance; a servant that though absent-minded she was compact of goodness. And so with many another in her respect and in that of the other four. We may pass over the conclusions to state that the book being finished was pronounced heretical and our scientific theologist Brother Juniper was burned alive with it—apparently to the great regret of everybody, but the simple persons of his time may not have had our overburdening experience with questionnairing.

With an apology to you and to Mr. Wilder for these few free quotations from *The Bridge of San Luis Rey,* couched in a crude English that does him no justice, I will leave you with the suggestion that you study further this remarkable statistical romance and I will venture the hope that should the author make a few dollars extra from royalties because of this hint of mine, he should apply them to securing a membership in our Association. Some of us need him in our business.

DIFFERENTIAL FERTILITY ACCORDING TO SOCIAL CLASS[1]

A STUDY OF 69,620 NATIVE WHITE MARRIED WOMEN UNDER 45 YEARS OF AGE BASED UPON THE UNITED STATES CENSUS RETURNS OF 1910

By Edgar Sydenstricker and Frank W. Notestein

The chief emphasis in discussions of population problems has been placed, until quite recently, upon two questions. One, propounded first by Malthus and reformulated many times since, is concerned with the prediction of the *size* of future populations, nations, and races. The approaches to this question have been considerably diversified by various students interested in its different phases and applications, such as the economic, the political, and the biological, and the data of the studies are largely national or broadly ethnological statistics of births, deaths, and census enumerations. The second concerns itself with the prediction of the future *composition* of a given population, usually the population of a nation, and the data are largely statistics bearing upon rates at which various component elements are reproducing themselves. The approach to this question has been chiefly biological, the eugenic applications being perhaps somewhat overdone. In fact, the future historians of the study of human population problems probably will be struck by the extraordinary amount of propaganda that has been let loose, and the unsatisfactory data upon which well-meaning and other persons have "viewed with alarm," from Malthus on.

A change in emphasis in the study and discussion of population problems seems to be evident in the growing tendency to question some of the assumptions that constitute the premises in our reasoning, in an impatience with mere generalizations from the trends of birth and death rates only, and in an increasing desire to collect more adequate data. More significant evidence of this change is found in the appearance of studies which are not confined to a purely biological, or political, or economic approach, but which recognize the influence of all of these as well as other factors. And, conversely, a significant indication is a

[1] From the Division of Research, Milbank Memorial Fund. Acknowledgments are made to Mr. W. M. Steuart, Director of the Census, for permission to use the original enumeration sheets and for facilities in extracting the data therefrom, and to Dr. J. A. Hill, Dr. Leon E. Truesdell, and Dr. Alba M. Edwards of the Bureau of the Census; Dr. Raymond Pearl, of the Institute of Biology, Johns Hopkins University; Dr. O. E. Baker of the U. S. Department of Agriculture; and Dr. Selwyn D. Collins of the U. S. Public Health Service, for counsel and assistance in the course of the study. The substance of this paper was presented before the Division on Social Statistics of the American Sociological Society on December 28, 1929.

recognition by students of other social phenomena of the necessity for taking population factors into account.

It was interest of the latter sort that led the Milbank Foundation into a study of certain phases of the population problem. In aiding public health activities, its directors and advisers have realized that any social effort which affects the death rate and the physical and mental well-being of a population becomes a factor in determining the character of the population itself. It was decided, therefore, to make such contributions as it could to the general study of population problems. The present paper is a progress report upon a chapter of one of its studies, namely fertility rates among native women of different social classes in the United States in 1910. It is proposed to bring this material up to date by later inquiries, and by more detailed studies of the interrelationships of trends in differential fertility rates, of changes in the sources of social groups for which rates of reproduction have been determined, and of differential mortality rates and other indices of physical status and change.

Differential fertility according to social class is, of course, a fact thoroughly established by many studies in Europe and Great Britain. Only a few American inquiries have been made and these either have been confined to small samples, such as those by Baber and Ross [1] and by Sydenstricker,[2] or were indirect statistical approaches to the question, such as those by Ogburn and Tibbits,[3] and Pearl.[4]

DATA OF PRESENT STUDY

In the censuses of 1890, 1900 and 1910 excellent data for the study of differential fertility according to social classes in the United States were obtained by asking each married woman the number of children she had borne. Unfortunately the returns were never tabulated except by Hill[5] in a study of differential fertility according to nativity and race in 1900.

The present study is based on samples taken from the original 1910 census schedules or enumeration sheets. In order to obtain an adequate and relatively homogeneous sample of each of certain social classes, the data selected were limited to those for wives in families in

[1] Baber and Ross, "Changes in the Size of American Families in One Generation," *University of Wisconsin Studies in the Social Sciences and History*, No. 10.

[2] Edgar Sydenstricker, "Differential Fertility According to Economic Status," *Public Health Reports*, Vol. 44, No. 35, August 30, 1929, pp. 2101–2106.

[3] W. F. Ogburn and Clark Tibbits, "Birth Rates and Social Classes," *Social Forces*, September, 1929, pp. 1–10.

[4] Raymond Pearl, "Differential Fertility," *The Quarterly Review of Biology*, Vol. II, No. 1, March, 1927, pp. 102–118.

[5] Joseph A. Hill, "Fecundity of Immigrant Women," *Reports of the Immigration Commission*, Vol. 28, pp. 731–826.

CHART I

MAP LOCATING THE CITIES AND COUNTIES FROM WHICH THE URBAN AND RURAL SAMPLES WERE TAKEN

CHART I

MAP LOCATING THE CITIES AND COUNTIES FROM WHICH THE URBAN AND RURAL SAMPLES WERE TAKEN

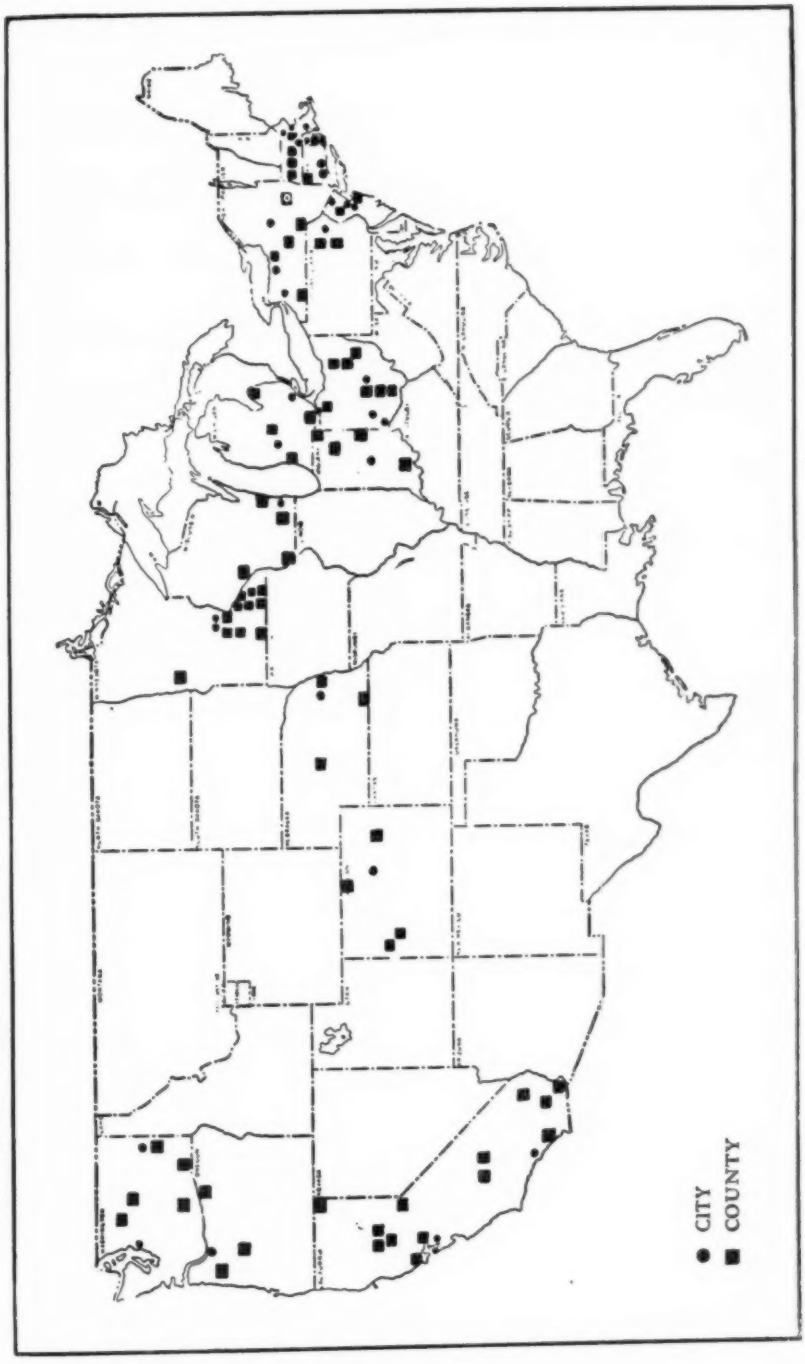


TABLE I

GEOGRAPHIC DISTRIBUTION OF 59,149 MARRIED WOMEN OF NATIVE-WHITE PARENTAGE FOR WHOM CERTAIN FERTILITY DATA WERE EXTRACTED FROM THE 1910 CENSUS RECORDS OF 33 CITIES

Area and locality	Number of women considered[1]	Percentage distribution of	
		Total women considered	Total women of similar color, marital status, nativity, and parentage in the population
Total from cities	59,149	99.9	100.0
New England	4,838	8.2	8.9
Massachusetts	2,541	4.3	3.9
Cambridge	683	1.2	0.9
Fall River	230	0.4	0.5
Lowell	359	0.6	0.8
Worcester	1,269	2.1	1.7
Rhode Island	938	1.6	2.4
Providence	938	1.6	2.4
Connecticut	1,359	2.3	2.6
Bridgeport	423	0.7	1.1
New Haven	936	1.6	1.5
Middle Atlantic	11,650	19.7	19.3
New York	7,869	13.3	11.0
Albany	1,386	2.3	1.6
Buffalo	2,869	4.9	4.1
Rochester	1,707	2.9	2.8
Syracuse	1,907	3.2	2.5
New Jersey	3,230	5.5	7.0
Jersey City	997	1.7	2.4
Newark	2,056	3.5	3.5
Paterson	177	0.3	1.1
Pennsylvania	551	0.9	1.3
Scranton	551	0.9	1.3
East North Central	18,918	31.9	32.8
Ohio	9,699	16.4	17.2
Cincinnati	1,695	2.9	5.3
Columbus	3,353	5.7	5.3
Dayton	2,684	4.5	3.3
Toledo	1,967	3.3	3.3
Indiana	5,878	9.9	7.4
Indianapolis	5,878	9.9	7.4
Michigan	2,733	4.6	6.2
Detroit	1,712	2.9	4.4
Grand Rapids	1,021	1.7	1.8
Wisconsin	608	1.0	2.0
Milwaukee	608	1.0	2.0
West North Central	4,817	8.2	7.7
Minnesota	2,831	4.8	5.5
Minneapolis	1,591	2.7	3.6
St. Paul	1,240	2.1	1.9
Nebraska	1,986	3.4	2.2
Omaha	1,986	3.4	2.2
Mountain (Colorado)	3,439	5.8	5.0
Denver	3,439	5.8	5.0
Pacific	15,487	26.1	26.3
Washington	4,234	7.1	7.1
Seattle	2,729	4.6	4.6
Spokane	1,505	2.5	2.5
Oregon	2,694	4.6	4.5
Portland	2,694	4.6	4.5
California	8,559	14.4	14.7
Los Angeles	6,232	10.5	8.4
Oakland	1,787	3.0	2.4
San Francisco	540	0.9	3.9

[1] Preliminary hand count. Includes 2,462 wives for whom data are excluded from the remaining tables. Of this number 2,440 were wives of persons not gainfully employed whose previous occupation was not stated, and 22 were wives for whom the data were inaccurate.

which both husband and wife were native white of native parents and were only once married. Altogether punch cards have been made for about 100,000 married women, approximately 60,000 of which constitute a sample of northern cities, and the remainder a sample of the rural parts of neighboring counties.

The urban sample was selected from the 33 northern cities having populations over 100,000 (in 1910) to insure urban conditions, and under 500,000 to avoid the dominating influence of our largest metropolitan centers (Chart I). It was intended to obtain cards for approximately the same proportion of the available population in each geographic division, and as nearly as practicable in each state and city sampled. However, in the interests of economy and of obtaining the sample of the native population from a more or less native environment, it was found desirable to take a disproportionately small number of cards in certain cities having a large proportion of foreign-born population. Table I shows the total number of cards obtained in each city,[1] with the per cent which that number forms of the total urban sample. To permit a rough comparison of the geographic distribution of the sample with that of the available population this table also gives the percentage distribution by cities of the married females over fifteen years of age who were native white of native parents.[2]

The geographic distribution of the rural sample might have been based on either of two principles: (1) That the women selected in each northern state should form a constant proportion of the available population, or (2) that those selected from any state should form approximately the same proportion of the total rural sample as those selected from the cities of that state formed of the total urban sample. The first method would give an accurate sample of the rural population of the northern states. The second would yield a geographic distribution comparable to that of the urban sample. Since one of the purposes of the study was to contrast the fertility of urban and rural women, comparable distributions were important, and the latter method was used, the sample being drawn from 74 counties (Chart I). As in the urban sample, however, it was found expedient to take a smaller sample in states having large foreign populations, and larger samples in those states where data were more readily obtained. Table

[1] Preliminary hand count. The wives of persons not gainfully employed whose previous occupations were not stated are included in this table but are excluded from the remainder of the study.

[2] The census figures for married women from which these percentages were computed do not strictly represent the available population, since the sample included only those families in which *both* the husband and wife qualified by nativity and the absence of re-marriage, and for which all the required data appeared to be accurately entered. In cities with large foreign populations there is more marriage between the native white of native parents and persons of foreign nativity and parentage than in predominately native cities.

II lists the number of cards obtained in each county,[1] and the per cent which the sample for each state forms of the total rural sample.

TABLE

GEOGRAPHIC DISTRIBUTION OF 43,352 MARRIED WOMEN, OF NATIVE-WHITE PAR-
1910 CENSUS RECORDS OF THE

Area and locality	Number of women considered *	Percentage distribution of	
		Total women considered	Total women considered in urban sample (Table I)
Total from rural districts	43,352	100.1	99.9
New England	3,114	7.2	8.2
Massachusetts	1,690	3.9	4.3
Berkshire	190		
Hampshire	574		
Middlesex	353		
Worcester	573		
Rhode Island	601	1.4	1.6
Kent	174		
Washington	427		
Connecticut	823	1.9	2.3
Litchfield	823		
Middle Atlantic	7,878	18.2	19.7
New York	5,368	12.4	13.3
Albany	778		
Cattaraugus	1,538		
Cortland	694		
Delaware	1,317		
Wayne	1,041		
New Jersey	2,092	4.8	5.5
Monmouth	1,584		
Morris	508		
Pennsylvania	418	1.0	0.9
Bradford	277		
Columbia	141		
East North Central	16,717	38.6	31.9
Ohio	10,336	23.8	16.4
Fayette	1,469		
Highland	2,248		
Madison	1,018		
Medina	1,360		
Tuscarawas	1,164		
Wayne	1,889		
Wood	1,188		
Indiana	4,058	9.4	9.9
Orange	1,049		
Randolph	1,379		
Steuben	818		
White	812		
Michigan	1,909	4.4	4.6
Allegan	600		
Gratiot	469		
Huron	61		
Lenawee	779		
Wisconsin	414	1.0	1.0
Grant	142		
Jefferson	100		
Sheboygan	99		
Trempealeau	73		

The reasons for taking a relatively small sample in cities with a large foreign population applied to the choice of wards within each city.

* Preliminary hand count. Includes the wives of farmers of unknown tenure, farm managers, and foremen who are excluded from the remainder of this study.

The method used was to begin the search for suitable material in the most native wards and to continue through increasingly foreign wards

II

ENTAGE, FOR WHOM CERTAIN FERTILITY DATA WERE EXTRACTED FROM THE RURAL PARTS OF 74 COUNTIES

Area and locality	Number of women considered*	Percentage distribution of	
		Total women considered	Total women considered in urban sample (Table I)
West North Central	3,056	7.1	8.2
Minnesota	1,643	3.8	4.8
Dakota	101		
Dodge	182		
Faribault	186		
Fillmore	220		
Goodhue	57		
Le Sueur	84		
Mower	208		
Olmstead	275		
Ottertail	260		
Scott	18		
Wabasha	52		
Nebraska	1,413	3.3	3.4
Custer	352		
Gage	818		
Washington	243		
Mountain	2,086	4.8	5.8
Colorado	2,086	4.8	5.8
Delta	362		
Larimer	501		
Mesa	794		
Washington	429		
Pacific	10,501	24.2	26.1
Washington	2,766	6.4	7.1
Chelan	165		
Columbia	234		
Skagit	246		
Whitman	1,067		
Yakima	1,054		
Oregon	1,791	4.1	4.6
Linn	918		
Morrow	205		
Yamhill	668		
California	5,944	13.7	14.4
Butte	385		
Colusa	189		
Eldorado	68		
Glenn	159		
Imperial	404		
Kings	397		
Modoc	273		
Orange	482		
Riverside	538		
San Bernardino	615		
Solano	174		
Sonoma	799		
Tulare	1,461		

*Preliminary hand count. Includes 813 wives for whom data were excluded from the remaining tables. Of this number 126 were wives of farmers whose tenure was unknown, 102 wives of farm overseers, 309 of farm managers and 276 wives for whom the data were inaccurate.

until the desired number of cards was obtained. If the object of the study had been to secure a typical sample of the native population this method probably would have introduced a bias. One would expect to

find a larger proportion of persons of high social status in native than in foreign districts. In this case however, the primary object was not to obtain a sample of the native population, but to obtain an adequate sample of *each social class*. It is doubtful if this method of selection would appreciably bias the results within the classes.

TABLE

DISTRIBUTION OF 99,226 MARRIED WOMEN, OF NATIVE-WHITE PARENTAGE, FOR ACCORDING TO OCCUPATIONAL GROUP

Social class and occupational group	Number of women	
Total		99,226
Total from cities		56,687
Professional		9,910
Lawyers, judges, and justices	2,433	
Physicians and surgeons [1]	1,957	
Technical engineers	1,329	
Teachers in college and school [2]	983	
Clergymen	827	
Dentists	635	
Accountants and auditors	410	
Authors, editors, and reporters	367	
Architects	323	
Other professional persons [3]	646	
Business		23,992
Salesmen and clerks in stores	3,514	
Retail dealers	3,216	
Other clerks	2,630	
Commercial travelers	1,730	
Real estate agents and officials	1,498	
Bookkeepers and cashiers	1,487	
Builders and building contractors	1,147	
Manufacturers and officials of manufacturing	1,268	
Managers and superintendents of manufacturing	774	
Insurance agents and officials of insurance companies	830	
Brokers, commission men, and promoters	597	
Wholesale dealers, importers and exporters	430	
Agents, canvassers, and collectors	741	
Draftsmen	411	
Conductors (steam railroad)	399	
Bankers and bank officials	322	
Other owners, proprietors and managers [4]	1,259	
Other clerical and kindred workers [5]	1,739	

[1] Includes osteopaths.
[2] Includes teachers of athletics and dancing.
[3] Includes: Artists, sculptors, and teachers of art; chemists, assayers, and metallurgists; designers and inventors; veterinary surgeons; librarians; selected public officials; and other professional persons.
[4] Includes: Managers and operators engaged in transportation and extraction of minerals; proprietors of employment offices, elevators, and warehouses; undertakers; owners, managers and officials of places of amusement; hotel keepers and managers; owners and managers of laundries; restaurant keepers; and saloon keepers.
[5] Includes: Baggagemen and freight agents; ticket, station, and express agents; express messengers and railway mail clerks; mail carriers; telegraph and telephone operators; floorwalkers, decorators, inspectors, gaugers, and samplers; musicians and teachers of music; semiprofessional pursuits; actors and showmen; housekeepers and stewards; and stenographers and typists.

In those states where data for the rural sample were easily obtained, the sample was taken from counties having land values and types of agriculture somewhat typical of the state as a whole; but in states having a large foreign population the sample was obtained in counties in which a relatively large proportion of the farmers were native born.

No data were transcribed for women living in incorporated villages, or even for those in unincorporated villages when they could be identified on the schedule. In the New England States, where villages are not incorporated, no data were taken from schedule pages containing records of a non-agricultural population.

III

WHOM FERTILITY DATA WERE EXTRACTED FROM THE 1910 CENSUS RECORDS, AND SOCIAL CLASS OF THE HUSBANDS

Social class and occupational group	Number of Women		
Skilled workers		18,454	
Carpenters	2,641		
Semiskilled operatives (n.o.s.) [6] in manufacturing industries	2,060		
Machinists, millwrights, and tool makers	1,846		
Conductors and motormen (street railroad)	1,094		
Painters, glaziers, and varnishers	1,026		
Foremen and overseers	763		
Other skilled workers in building trades	748		
Locomotive engineers and firemen (steam railroad)	713		
Engineers (stationary), cranemen, hoistmen, etc.	683		
Brakemen, switchmen, flagmen, and yardmen	586		
Electricians	581		
Compositors, linotypers, and typesetters	521		
Barbers and hairdressers	454		
Plumbers, and gas and steam fitters	413		
Blacksmiths, forgemen, and hammermen	324		
Other skilled workers [7]	2,770		
Other semiskilled workers [8]	1,231		
Unskilled laborers		4,331	
Draymen, teamsters, expressmen, and carriage and hack drivers	1,043		
Laborers (building, general, and not specified)	827		
Deliverymen	536		
Laborers (n.o.s.) [6] in manufacturing industries	598		
Other laborers engaged in transportation	341		
Janitors and sextons	210		
Other laborers [9]	776		
Total from rural districts			42,539
Farm owners		25,697	
Farm renters		11,886	
Farm laborers		4,956	

[6] Not otherwise specified.

[7] Includes: Bakers; boilermakers; electrotypers, stereotypers, and lithographers; engravers; jewelers, watchmakers, goldsmiths, and silversmiths; mechanics; moulders, founders, and casters (of metal); pattern and model makers; pressmen and plate printers (printing); tailors; tinsmith and coppersmiths; other skilled workers in non-precious metal; proprietors and managers of garages, transfer companies, and livery stables; inspectors (transportation); firemen (fire department); policemen; photographers; detectives, sheriffs, and keepers of institutions; and cooks.

[8] Includes: Mine, quarry, and oil and gas well operatives; filers, grinders, buffers, and polishers (metal); chauffeurs; telegraph and telephone linemen; other semiskilled operatives engaged in transportation industries; boarding and lodging house keepers; launderers, and laundry operatives; waiters; and bartenders.

[9] Includes: Firemen (except locomotive and fire department); laborers in coal and lumber yards, warehouses and stores; laborers in public service; bootblacks; chairmen; elevator tenders; other laborers in domestic and personal service; guards, watchmen, doorkeepers, and guides (public service).

When the districts had been chosen, the bound volumes of schedules were given to clerks with a list of the enumeration districts from which the data were to be secured. The clerks then proceeded to search the schedules, hunting first for a husband and wife who were both native of native parents. Such a couple found, they looked to see if both husband and wife were white, and if so that neither of them had been

married more than once. Having found such a family they began transcribing the facts concerning the age of wife, the number of years married, the number of children born and living, the occupation of the husband, and the tenure of the home. The occupations of the husbands in the urban sample were coded according to the *Census Index to Occupations* for 1920. For the rural sample, data were selected for the wives of farmers, farm managers, foremen, and laborers only.[1] If the clerks found that part of the required information was missing, not precisely stated, or inconsistent with other information, the individual was omitted. An adequate sample of the wives of professional persons could not be obtained without a special search. In obtaining the urban sample, therefore, after one-third of the schedule pages of an enumeration district had been searched, the clerk selected data for the wives of professional persons only. In the initial stages of the inquiry the work of each clerk was checked until the errors became negligible, and thereafter samples were examined to insure the maintenance of a high standard of accuracy.

DIFFERENTIATION BY "SOCIAL CLASS"

No little temerity is required of the student who undertakes the assignment of wives into social classes on the basis of the census returns of the husbands' occupations. "Social class" is itself difficult to define precisely. It is obvious, for example, that there is a substantial range in the social status of wives of grocers, or insurance agents, or musicians. In view of the absence of information which would make possible an accurate differentiation of certain income groups, the method adopted was to differentiate only those broad and conventionally accepted social classes within which one expects to find a certain homogeneity in standards of education and achievement and in the general social environment, but within which there undoubtedly exists a substantial range of economic well-being. The wives in the urban sample were separated into four classes according to their husbands' occupation: (1) Professional, (2) Business, (3) Skilled Workers, and (4) Unskilled Laborers; and those in the rural sample into three classes: (1) Farm Owners, (2) Farm Renters, and (3) Farm Laborers.[2] The chief occupational groups included in each of these classes and the number of women considered in each group are shown in Table III.[3]

When the multiplicity of urban occupations are separated into four

[1] Since the number of cards obtained for wives of farm managers and foremen was too small to yield significant results they have been omitted from this study.

[2] As a matter of convenience, wives are designated by the occupations of their husbands.

[3] Much of the detail of this classification has been taken from "Social-Economic Groups in the United States," by Alba M. Edwards, this JOURNAL, Vol. 15, pp. 643–661.

classes, the titles of the classes must be suggestive rather than precise. Any occupation not obviously fitting into one of these classes, was assigned to that class in which the general social standards appeared to be most nearly similar to its own. For example, foremen and policemen were included with the Skilled Worker Class. There are also a number of groups which, if classified according to the character of work performed, would fall in classes having social standards quite dissimilar to their own. In such cases the character of work was ignored, and the

TABLE IV

AGE DISTRIBUTION OF MARRIED WOMEN, OF NATIVE-WHITE PARENTAGE, FOR WHOM FERTILITY DATA WERE EXTRACTED FROM THE 1910 CENSUS, IN URBAN AND RURAL AREAS; WITH THE PERCENTAGE DISTRIBUTION FOR EACH GROUP

Age of women at census 1910	Number of women					Percentage distribution of		
	Total		Urban		Rural	Total Adjusted [1]	Urban Adjusted [1]	Rural
	Actual	Adjusted [1]	Actual	Adjusted [1]				
All ages	99,226	92,619	56,687	50,080	42,539	100.01	99.99	99.99
Under 20	1,894	1,877	882	865	1,012	2.03	1.73	2.38
20-24	11,192	10,801	6,516	6,125	4,676	11.66	12.23	10.99
25-29	16,105	15,080	10,117	9,092	5,988	16.28	18.15	14.08
30-34	15,245	14,069	9,414	8,238	5,831	15.19	16.45	13.71
35-39	13,635	12,558	8,159	7,082	5,476	13.56	14.14	12.87
40-44	11,549	10,685	6,668	5,804	4,881	11.54	11.59	11.47
45-49	9,352	8,637	5,126	4,411	4,226	9.33	8.81	9.93
50-54	7,851	7,300	4,091	3,540	3,760	7.88	7.07	8.84
55-59	5,423	5,076	2,723	2,376	2,700	5.48	4.74	6.35
60-64	3,691	3,456	1,690	1,455	2,001	3.73	2.91	4.70
65-69	2,061	1,926	873	738	1,188	2.08	1.47	2.79
70-74	876	825	311	260	565	.89	.52	1.33
75-79	277	260	93	76	184	.28	.15	.43
80-84	65	61	21	17	44	.07	.03	.10
85-89	9	8	2	1	7	.01	.00	.02
90-94	1	...	1	...	...	...	...	...

[1] Since the sample for the professional class was obtained from three times as many schedule pages as those for the other urban classes, it is given one-third of its actual weight.

groups were assigned to classes which appeared to have similar social standards. For example, musicians, who in this study are largely theater musicians, and actors, who for the most part are vaudeville people, were not included with professional persons because it seemed likely that their incomes, standards of achievement, and social backgrounds were more similar to those of the clerical worker than to those of professional persons. Accordingly they were placed in the Business Class. Garage and livery stable owners, and managers and proprietors of transfer companies (dominated by livery stable owners and including the owners of single drays) were included in the Skilled Worker Class because it seemed probable that their average income was lower than that of the Business Class, and that their social status corresponded

roughly to that of the manual worker. Hucksters, peddlers, junkmen, newsboys, and keepers of boarding houses were not included in the Business Class for the same reason. However, each of the classes as represented here is dominated by groups about the classification of which there can be no doubt.

Table IV presents the age distributions of the wives in the urban and rural samples. As one would expect, the rural sample has a larger proportion in both the young and old ages, but a smaller proportion in the active years of middle life than the urban sample (Chart II). The median age[1] for the wives of the rural sample is 37.5 as contrasted with 34.5 for those of the urban sample.

TABLE V

AGE DISTRIBUTION OF MARRIED WOMEN, OF NATIVE-WHITE PARENTAGE FOR WHOM FERTILITY DATA WERE EXTRACTED FROM THE 1910 CENSUS, IN EACH URBAN SOCIAL CLASS; WITH THE PERCENTAGE DISTRIBUTION FOR EACH CLASS

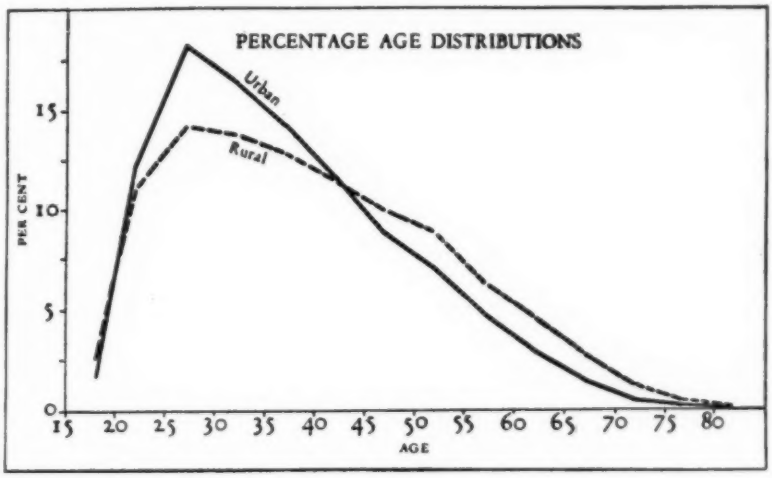
Age of women at census 1910	Number of women in each social class				Percentage distribution of each class			
	Professional	Business	Skilled worker	Unskilled laborer	Professional	Business	Skilled worker	Unskilled laborer
All ages	9,910	23,992	18,454	4,331	100.01	100.00	99.99	99.98
Under 20	26	235	449	172	.26	98	2.43	3.97
20–24	587	2,401	2,857	671	5.92	10.01	15.48	15.49
25–29	1,538	4,146	3,699	734	15.52	17.28	20.04	16.95
30–34	1,764	3,997	3,066	587	17.80	16.66	16.61	13.55
35–39	1,616	3,653	2,377	513	16.31	15.23	12.88	11.84
40–44	1,296	3,043	1,906	423	13.08	12.68	10.33	9.77
45–49	1,072	2,259	1,399	396	10.82	9.42	7.58	9.14
50–54	826	1,832	1,123	310	8.34	7.64	6.09	7.16
55–59	520	1,125	805	273	5.25	4.69	4.36	6.30
60–64	352	762	439	137	3.55	3.18	2.38	3.16
65–69	202	373	220	78	2.04	1.55	1.19	1.80
70–74	77	112	92	30	.78	.47	.50	.69
75–79	26	43	18	6	.26	.17	.10	.14
80–84	6	10	4	1	.06	.04	.02	.02
85–89	1	1	...	...	.01	...	...	...
90–94	1	...	...	...	.01	...	...	...

The median ages of the urban classes are: Professional, 37.2; Business, 35.7; Skilled Workers, 32.6; and Unskilled Laborers, 34.0 (Table V and Chart III). It is possible that the long period of training required for the professions is reflected in the higher average age of the wives of that class. The age distribution of the Unskilled Laborer Class suggests the possibility that some persons who at one time would have been found in other classes have gravitated to it. This probably is accounted for by the inclusion in this class of guards, watchmen, and kindred occupations into which the physically incapacitated, modestly pensioned, and failures tend to drift. Undoubtedly other shifting

[1] Calculated from quinquennial age groups to avoid the distortion due to concentration on years divisible by two and five.

CHART II

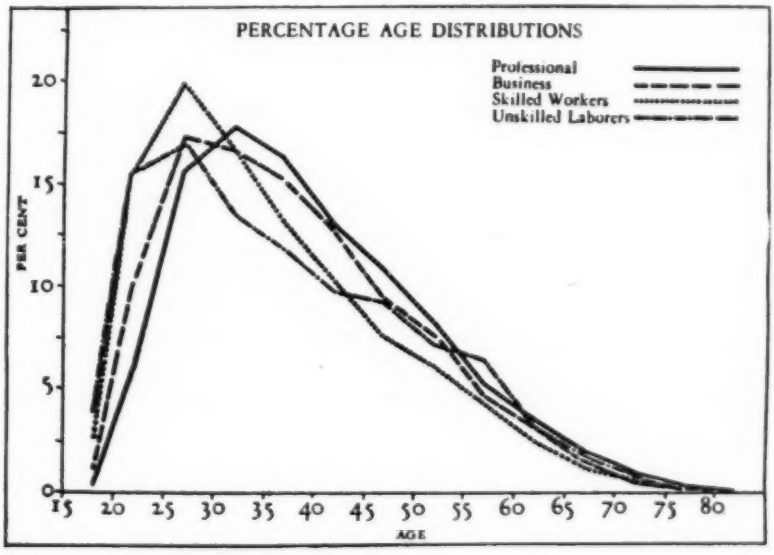
PER CENT OF TOTAL WIVES IN URBAN AND RURAL AREAS IN EACH QUINQUENNIAL AGE GROUP



from class to class has taken place. For example, artisan builders become contractors, jewelers become merchants, and young laborers machine operators. In general however, so far as may be judged from

CHART III

PER CENT OF TOTAL WIVES OF EACH URBAN SOCIAL CLASS IN EACH QUINQUENNIAL AGE GROUP



these age distributions, the classes appear to be relatively self-contained.

The median ages for the rural social classes are as follows: Farm Owners, 42.7; Farm Renters, 30.8; and Farm Laborers, 27.9. The percentage age distributions appear in Table VI and Chart IV. Whereas

TABLE VI

AGE DISTRIBUTION OF MARRIED WOMEN, OF NATIVE-WHITE PARENTAGE FOR WHOM FERTILITY DATA WERE EXTRACTED FROM THE 1910 CENSUS, IN EACH RURAL SOCIAL CLASS; WITH THE PERCENTAGE DISTRIBUTION FOR EACH CLASS

Age of women at census 1910	Number of women in each social class			Percentage distribution of each social class		
	Farm owners	Farm renters	Farm laborers	Farm owners	Farm renters	Farm laborers
All ages	25,697	11,886	4,956	100.02	100.02	99.99
Under 20	156	438	418	.61	3.69	8.43
20–24	1,238	2,164	1,274	4.82	18.21	25.71
25–29	2,356	2,621	1,011	9.17	22.05	20.40
30–34	3,109	2,036	686	12.10	17.13	13.84
35–39	3,423	1,571	482	13.32	13.22	9.73
40–44	3,488	1,082	311	13.57	9.10	6.28
45–49	3,202	777	247	12.46	6.54	4.98
50–54	3,045	524	191	11.85	4.41	3.85
55–59	2,227	336	137	8.67	2.83	2.76
60–64	1,709	190	102	6.65	1.60	2.06
65–69	1,030	91	67	4.01	.77	1.35
70–74	503	38	24	1.96	.32	.48
75–79	161	18	5	.63	.15	.10
80–84	43	...	1	.17	...	.02
85–89	7	...	...	.03	...	...

the population of the urban sample lived in a diversity of environments and drew its livelihood from a variety of industries, that of the rural sample lived in the relatively uniform environment of an agricultural society. The social classes of the rural sample distinguish degrees of economic success rather than differences in general social standards. This ranking of the social classes was therefore to be expected. Many young laborers become renters, and renters, owners in the course of ordinary advancement. The younger ages of the lower classes are made up in part of people who will never leave them, and in part of persons who at a later date would be found in one of the higher classes. From that point of view the younger ages of the Laborer and Renter Classes are less homogeneous than the older ages.

DIFFERENTIAL FERTILITY RATES FOR WOMEN OF CHILD-BEARING AGES

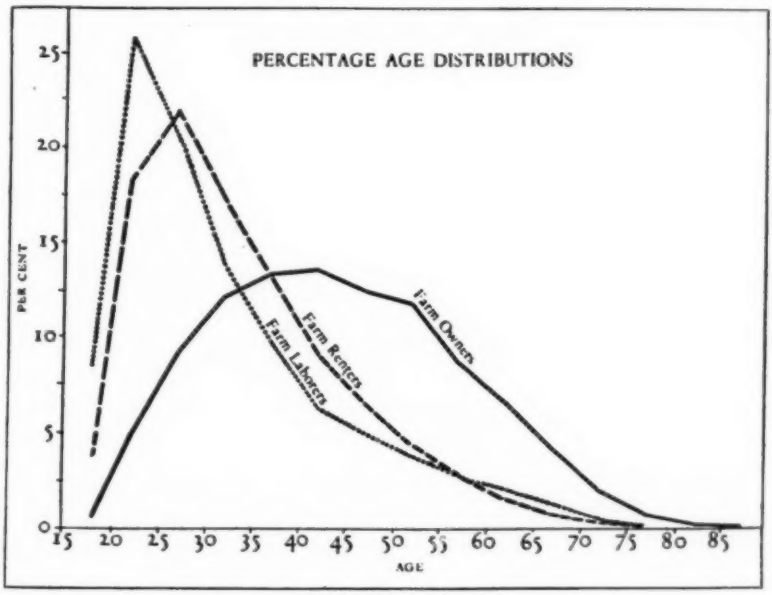
This paper, as a report of progress, is limited to a consideration of the data obtained for women in the child-bearing ages. In it is discussed only the net fertility of women in each social class. In later papers attempts will be made to measure the influence of specific causal factors

such as age at marriage, and the no-child family in determining the net fertility, and of child mortality in determining the effective net fertility of the social classes.

The fertility of a given social class is the resultant of many variables, among the more important of which are: age of wife, age of wife at marriage, sterility, fecundity, and a large number of mores bearing on the voluntary control of pregnancy. Of these factors, the age of the wife is unique in that it determines the length of time during which the

CHART IV

PER CENT OF TOTAL WIVES OF EACH RURAL SOCIAL CLASS IN EACH QUINQUENNIAL AGE GROUP



other factors exercise their influence, and, of course, the opportunity which any group of wives has for bearing children. To obtain a fair comparison of the fertility of the social classes, these opportunities must be equal, that is, comparisons must be made between groups having the same age distributions. For example, the fact that the wives of farm renters bear, on the average, fewer children than the wives of farm owners, does not indicate that the former group is less fertile, but that it is younger. The true relation can only be obtained by comparing the average number of children born to wives of farm owners and farm renters who are the same age.

In a sense, age at marriage also determines the opportunity for child-

bearing. But this, no less than the various other mores governing the sex relation, is a recognized means by which all societies condition the biological factors governing reproduction. Since the purpose of this paper is to determine the *net effect* of all the factors bearing on the fertility of a given class, age at marriage was included with these other factors as a variable.

Two methods of expressing the net fertility of the social classes have been employed, both of which conform to the requirements that age of the wife be eliminated, but that all the other factors influencing the average number of children born be included as variables. The first is the cumulative birth rate for specific age groups, that is, the number of children born per 100 wives for each quinquennial age group. Table

TABLE VII

CHILDREN BORN, WIVES, AND CHILDREN BORN PER 100 WIVES BY AGE OF WIFE AT THE CENSUS, FOR THE URBAN AND RURAL AREAS

Children born, wives, and children born per 100 wives for urban and rural areas	Age of wife at the census of 1910						
	Total under 45	Under 20	20–24	25–29	30–34	35–39	40–44
Children born							
Urban [1]	59,522	393	5,112	11,128	13,664	14,788	14,437
Rural	72,543	549	5,557	11,772	16,203	18,838	19,624
Wives							
Urban [1]	37,206	865	6,125	9,092	8,238	7,082	5,804
Rural	27,864	1,012	4,676	5,988	5,831	5,476	4,881
Children born per 100 wives							
Urban [1]	160	45	83	122	166	209	249
Rural	260	54	119	197	278	344	402

[1] Since the sample for the professional class was obtained from three times as many schedule pages as those for the other urban classes, it is given one-third of its actual weight.

VII presents these cumulative birth rates, and the data from which they were obtained, for the urban and rural samples. Table VIII presents the same material for each rural, and Table IX for each urban social class. By means of these ratios, the fertility of the classes may be compared for each age group. It is also desirable to obtain a single figure which will summarize this series of ratios for each class. Such a figure is to be had in the standardized cumulative birth rate (Table X). These rates may be interpreted as indicating the number of children which would have been born to the wives of a given class, if the age distribution of the wives of that class had been the same as that of the standard population—the standard in this case being the combined urban and rural samples.[1]

[1] Since the crude rates for both the urban and rural samples are the same as the standardized rates, it appears that either the urban or rural samples alone, if used as a standard, would have yielded the same results.

TABLE VIII

CHILDREN BORN, WIVES, AND CHILDREN BORN PER 100 WIVES BY AGE OF WIFE AT THE CENSUS, FOR EACH RURAL SOCIAL CLASS

Children born, wives, and children born per 100 wives for each social class	Age of wife at the census of 1910						
	Total under 45	Under 20	20–24	25–29	30–34	35–39	40–44
Children born							
Farm owners	38,470	78	1,515	4,432	8,225	11,112	13,108
Farm renters	24,372	226	2,440	5,102	5,781	5,773	5,050
Farm laborers	9,701	245	1,602	2,238	2,197	1,953	1,466
Wives							
Farm owners	13,770	156	1,238	2,356	3,109	3,423	3,488
Farm renters	9,912	438	2,164	2,621	2,036	1,571	1,082
Farm laborers	4,182	418	1,274	1,011	686	482	311
Children born per 100 wives							
Farm owners	279	50	122	188	265	325	376
Farm renters	246	52	113	195	284	367	467
Farm laborers	232	59	126	221	320	405	471

TABLE IX

CHILDREN BORN, WIVES, AND CHILDREN BORN PER 100 WIVES BY AGE OF WIFE AT THE CENSUS, FOR EACH URBAN SOCIAL CLASS

Children born, wives, and children born per 100 wives for each social class	Age of wife at the census of 1910						
	Total under 45	Under 20	20–24	25–29	30–34	35–39	40–44
Children born							
Professional	9,661	9	349	1,364	2,352	2,856	2,731
Business	25,420	87	1,580	4,324	5,871	6,732	6,826
Skilled workers	24,463	201	2,657	5,065	5,666	5,585	5,289
Unskilled laborers	6,419	102	759	1,284	1,343	1,519	1,412
Wives							
Professional	6,827	26	587	1,538	1,764	1,616	1,296
Business	17,475	235	2,401	4,146	3,997	3,653	3,043
Skilled workers	14,354	449	2,857	3,699	3,066	2,377	1,906
Unskilled laborers	3,100	172	671	734	587	513	423
Children born per 100 wives							
Professional	142	35	59	89	133	177	211
Business	145	37	66	104	147	184	224
Skilled workers	170	45	93	137	185	235	277
Unskilled laborers	207	59	113	175	229	296	334

TABLE X

STANDARDIZED CUMULATIVE BIRTH RATE FOR EACH URBAN AND RURAL SOCIAL CLASS[1]

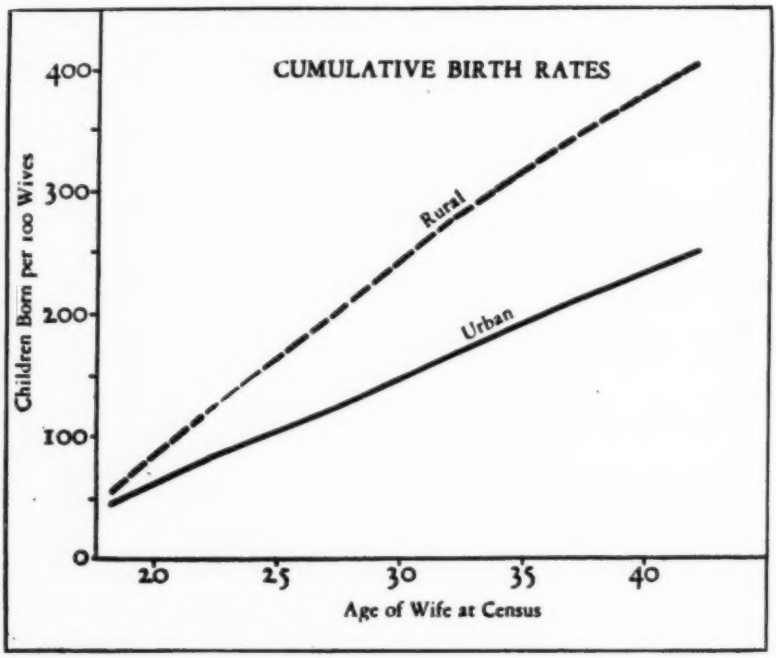
Urban Sample	160
Professional	129
Business	140
Skilled workers	179
Unskilled laborers	223
Rural Sample	260
Farm owners	247
Farm renters	275
Farm laborers	299

[1] Obtained by applying the rate for each quinquennial age group under 45 to the age distribution of the combined urban and rural samples.

Before attention is turned to a detailed consideration of the cumulative birth rates, a common, and at first glance anomalous, characteristic of all of them should be noted. There is no tendency for the curves presented in Charts V, VI, and VII to approach an asymptote near the end of the child-bearing period. If the data represented one generation passing through life, such results would lead to the absurd conclusion that the average annual increment to the family did not decrease with

CHART V

CHILDREN BORN PER 100 WIVES IN EACH QUINQUENNIAL AGE GROUP UNDER 45, FOR URBAN AND RURAL AREAS



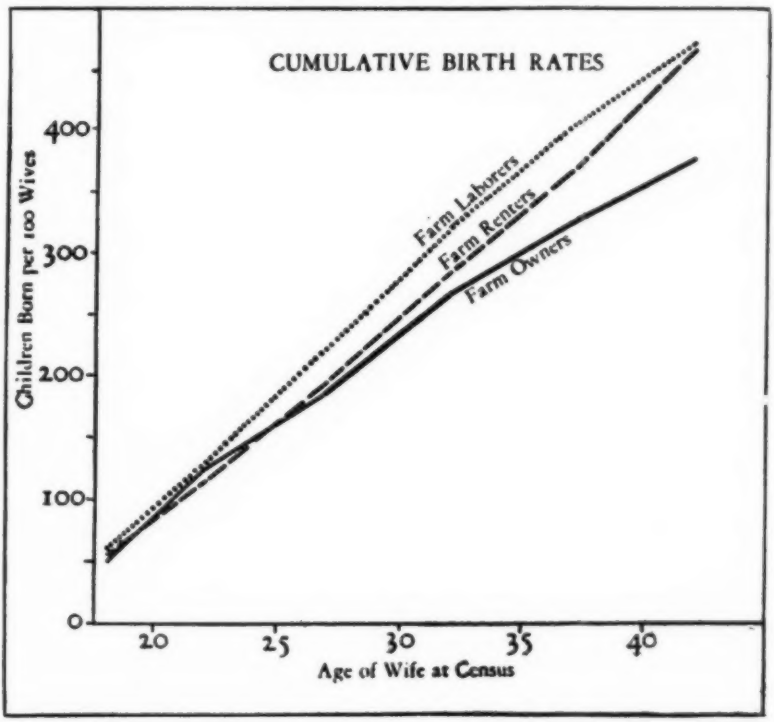
the advancing age of the wife. But instead of representing one generation these data represent wives who were from 14 to 44 years of age in 1910, that is, wives who entered the child-bearing period between 1880 and 1910. Since these years witnessed a sharp decline in the birth rate, the families of the younger wives of this study are not only less nearly complete, but never did become as large as those of the older groups. No attempt is made in this paper to determine the respective influence of these two factors in shaping the curves here presented. It is sufficient to note that the influence of the falling birth

rate is probably least in the younger groups and becomes of increasing importance with the advancing age of the wife.

It is apparent from a glance at Chart V (Table VII) that the wives of the rural sample are distinctly more fertile than those of the urban sample. The specific rates for the rural sample are from 20 to 67 per cent higher than the corresponding urban rates, and the standardized rural rate is 63 per cent higher than that for the urban sample (Chart

CHART VI

CHILDREN BORN PER 100 WIVES IN EACH QUINQUENNIAL AGE GROUP UNDER 45, FOR EACH RURAL SOCIAL CLASS



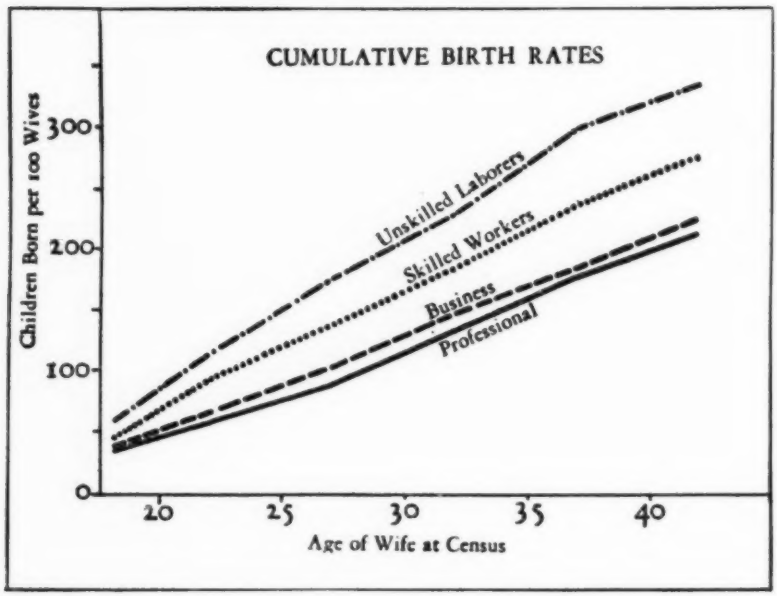
VIII and Table X). Or, to put it another way, in a population having the age distribution of the standard, 1,000 children would have been born to 625 wives of the urban sample and to but 385 wives of the rural group.

The relative similarity of the environment and social standards of the rural classes might lead one to expect slight differences in their fertility. From Chart VI and Table VIII it will be seen, however, that marked differences do exist. The specific rates for the most

fertile class, the Farm Laborers, are from 3 to 25 per cent higher than those for the least fertile class, the Farm Owners, and the standardized rate (Chart VIII and Table X) is 21 per cent higher. All of the specific rates for the Farm Renter Class are lower than those for the Farm Laborer Class, and with one exception[1] those for the Farm Owner Class are in turn lower than the corresponding ones for the Farm Renter Class. In a population having the age distribution of the standard, 1,000 children would have been born to 405 wives of farm owners, 364

CHART VII

CHILDREN BORN PER 100 WIVES IN EACH QUINQUENNIAL AGE GROUP UNDER 45, FOR EACH URBAN SOCIAL CLASS



wives of farm renters, and 334 wives of farm laborers. In the rural population represented by this sample, there is therefore a definite inverse relation between fertility and social status.

The differences in the net fertility of the urban social classes are even more definite (Table IX and Chart VII). The specific rates for the most fertile class, the Unskilled Laborers, are from 58 to 97 per cent higher than those for the least fertile, the Professional Class, and the standardized rate is 73 per cent higher. In a population having the age distribution of the standard, 1,000 children would have been born

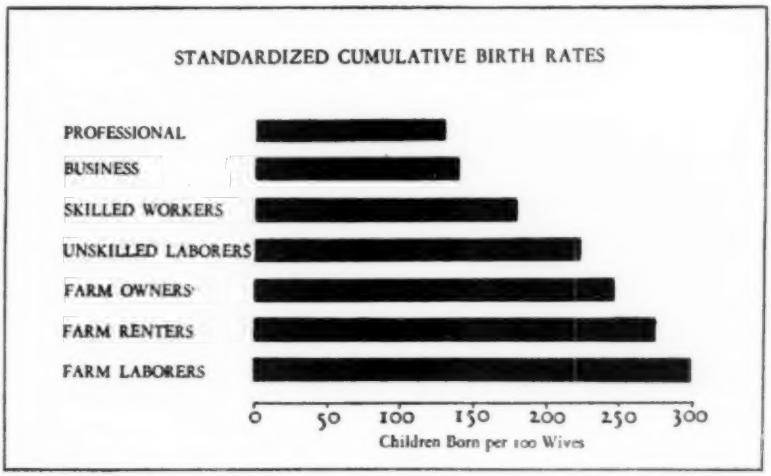
[1] The rate for the Farm Renter Class is lower than that for the Farm Owner Class at age group 20-24. This may be accounted for by the different age distributions within the group. See Chart IV.

to 775 wives in the Professional Class, 714 wives in the Business Class, 559 wives in the Skilled Worker Class, and 448 wives in the Unskilled Laborer Class. Moreover the ranking of the classes by fertility indicated by the rates for each age group is the same as that shown by the standardized rates. It should be observed that the relative difference between the standardized rates for the Professional and Business Classes is less than half those between the other urban classes. In general however, the inverse relation between fertility and the conventional ranking of the social classes here identified is even more marked than in the rural sample.

CHART VIII

STANDARDIZED CUMULATIVE BIRTH RATES FOR EACH URBAN AND RURAL SOCIAL CLASS

(Obtained by applying the rate for each quinquennial age group under 45 to the age distribution of the combined urban and rural samples)



Attention has been called to the fact that the rates for the rural sample, taken as a unit, are distinctly higher than those for the urban sample taken as a unit. It should now be noted that, with two unimportant exceptions[1] none of the specific rates for the urban classes exceed the corresponding rates for any rural class. The standardized rate for the most fertile urban class (223 for the Unskilled Laborers) is definitely lower than that for the least fertile rural class (247 for Farm Owners). Therefore the relatively high rate for the rural sample is characteristic of the rural population, and is not caused by the different

[1] The rate for wives of Unskilled Laborers under 20 years of age (59) exceeds those for Farm Owners (50) and Farm Renters (52). The rates are based on 245, 156, and 438 cases respectively.

weights of high and low fertility classes within the urban and rural samples.

DIFFERENTIAL FERTILITY RATES FOR WIVES OF MEN IN CERTAIN SPECIFIC OCCUPATIONS

It has been pointed out above that several occupations were of necessity assigned to social classes somewhat arbitrarily, and that several of the classes include occupations representing a considerable

TABLE XI

STANDARDIZED CUMULATIVE BIRTH RATES FOR SELECTED OCCUPATIONAL GROUPS AND FOR EACH URBAN CLASS [1]

Social class and occupational group	Number of wives	Standardized cumulative birth rate [1]
Professional	7,899	145
Lawyers, physicians, and surgeons	3,369	142
Business	19,734	155
Selected officials, owners, etc. [2]	1,082	155
Retail merchants	2,477	153
Selected clerks [3]	5,271	145
Builders and building contractors	875	212
Skilled workers	15,753	194
Selected skilled workers [4]	6,245	208
Selected semiskilled workers [5]	3,386	191
Unskilled laborers	3,496	242
Selected unskilled laborers [6]	1,616	259

[1] Obtained by applying the rate for each decennial age group under 50 to the age distribution of the combined urban and rural samples. These rates are not precisely comparable with those in Table X.

[2] Includes: Officials of manufacturing; officials and superintendents of steam and street railroads; bankers and bank officials; stockbrokers; officials of insurance companies; and other officials, proprietors, and managers engaged in transportation and the extraction of minerals.

[3] Includes: Salesmen and clerks in stores, and "other clerks" (a census title including a variety of clerical workers).

[4] Includes: Blacksmiths, forgemen, and hammermen; boiler makers; brick and stone masons; cabinet makers; carpenters; compositors, linotypers, and typesetters; electricians; electrotypers, stereotypers, and lithographers; engravers; mill-wrights; toolmakers, die setters, and sinkers; molders, founders, and casters (metal); painters, glaziers, and varnishers (building); paper hangers; plasterers and cement finishers; plumbers, and gas and steam fitters; pressmen and plate printers (printing); other skilled workers in the building trades; tinsmiths and coppersmiths; and locomotive engineers.

[5] Includes: Semiskilled operatives (not otherwise specified) in automobile factories, car and railroad shops, other metal-working industries, lumber and furniture industries, shoe factories and other manufacturing industries; brakemen, conductors (street railroads); motormen (street railroad); and switchmen, flagmen, and yardmen.

[6] Includes: Laborers, building, general and not specified; laborers (not otherwise specified) in manufacturing industries; steam and street railway laborers; barn, garage, road and street laborers; other laborers in transportation, laborers in coal and lumber yards, warehouses and stores; and laborers in public service.

range of economic well-being. The question naturally arises: To what extent are the classes thus formed homogeneous with respect to fertility? Is it not possible that the different rates obtained for the classes may reflect merely the different weights of high and low fertility groups within the classes? Some light is thrown on this problem by the standardized rates for selected groups of readily classifiable occupations presented in Table XI. It should be observed that these rates are based on a

slightly different age grouping than those of Table X and are not therefore precisely comparable with them.[1]

The rate for wives of lawyers and physicians, selected to represent the Professional Class, is practically the same as that for the entire class.

The rates for Selected Officials, Owners, etc., presumably a high income group, and for Retail Merchants, a fairly typical group of owners, are virtually the same as that for the entire Business Class, but the rate for Selected Clerks is definitely lower than that for the Business Class and is the same as that for the Professional Class.[2] It is possibly worth noting that this lowest fertility group of the Business Class is also the lowest income group of the class. The overlapping of the rate for the Professional Class and that for a selected group of the Business Class is not unexpected, since the two classes have somewhat similar standards of education and achievement for their children, and much the same social background.

As none of these rates are higher than that for the class, and as the groups represented form a substantial proportion of the class, it is apparent that some group or groups must have high rates. An examination of the rates for each occupational group revealed that although there was some divergency from the rate for the class, Builders and Building Contractors were the only group of importance for which the rate was definitely out of the range of the class. This group, which forms about 5 per cent of the class, has a standardized rate of 212, as compared with 155 for the class. When it is observed that the rate for Selected Skilled Workers is 208, one is led to wonder whether a substantial number of artisan builders might have been included in the group. In obtaining the data, however, the clerks were given instructions to code as contractors only those persons returned as such who were also returned as employers. Probably some artisans did return themselves as employers by way of expressing an aspiration rather than a fact, but this would scarcely be the case for a significant proportion of the group. It must be remembered that contracting is frequently a small business requiring little capital. Therefore a more probable explanation of the similarity of the rates for Skilled Workers and contractors would seem to be that a substantial proportion of the contractors here represented came from the artisan class after their families were nearly completed.

Neither of the rates for the selected groups of the Skilled Worker Class approaches that for any other class. The rate for Selected Semi-skilled Workers is slightly but definitely lower than that for Selected

[1] Since at present the material is available only for decennial age groups, the rates in Table XI are based on data for all wives under 50 years of age.

[2] See the notes to Table XI for a list of the occupations included in each of the selected groups.

Skilled Workers. Here appears therefore a case parallel to that of the Selected Clerical Workers in the Business Class. The Selected Semi-skilled Group which is the lower fertility group of the Skilled Worker Class is probably also the lower income group of that class.

The rate for Selected Unskilled Laborers is higher than that for the class as a whole. Inspection of the rates for the remaining occupations made it apparent that the rate for the class was kept down by the inclusion of servants and of those occupations which draw a large proportion of the incapacitated from other social classes.

The analysis of the rates for the selected groups indicates that in general the social classes are fairly homogeneous with respect to fertility. With the two exceptions noted the rates for the selected groups were much nearer that for their own class than that for any other class.

SUMMARY

The results of this study of the differential fertility of 69,620 wives who have passed through the same proportion of their reproductive period may be summarized as follows:

(1) The rural population represented by this sample is definitely more fertile than the urban population.

(2) This greater fertility is characteristic of each rural class.

(3) In both the urban and rural populations studied, there is a definite and consistent inverse relation between fertility and the customary ranking of the broad social classes, but the differences are greater in the urban than in the rural population.

(4) The rates for certain specific large occupational groups within certain urban classes differ from the rate for the class as a whole, but with two exceptions these rates are much nearer that for their own class than that for any other.

(5) The difference in the fertility of the Professional and Business Classes is less marked than the differences between the other urban classes.

(6) It is possible that the inverse relation between fertility and social status observed for the broad social classes does not exist within every urban class. Within the two classes for which the rates of contrasting groups were presented the low fertility groups were also the low income groups. Further study of the data will be required to ascertain the precise significance of these relations.

A MISTAKEN CONCEPTION OF THE CENTER OF POPULATION

By Walter Crosby Eells, *Stanford University*

An unfortunate error in an effort to popularize an understanding of the properties of the point known as the "center of population" has repeatedly occurred in various publications of the United States Census Bureau. From this source it has spread to various books on sociology and population problems, and seems to have remained unchallenged for almost twenty years.

In the special bulletin of the Fourteenth (1920) Census dealing with center of population and median lines the following definitions and properties are stated:[1]

> A somewhat technical significance, different from that frequently given to it, attaches to the term "Center of population" as used in census publications. The center is often understood to be the point of intersection of a north and south line, which divides the population equally, with an east and west line which likewise divides it equally. This point of intersection is, in a certain sense, a center of population; it is here, however, designated the median point to distinguish it from the point technically defined as the center. There are points different in character which may be termed "center of population," but at each census the term "center of population" has been applied to the point which may be considered as the center of gravity of the United States; in other words, the point upon which the United States would balance, if it were a rigid plane without weight and the population distributed thereon, each individual being assumed to have equal weight and to exert an influence upon the central point proportional to his distance from the point. The pivotal point, therefore, would be its center of gravity and is the point referred to by the term used in the census as "center of population." This is sometimes confused with another point, which we term the "median point." Continuing the above analogy it may be noted that the median point, which may be described as the numerical center of population, is in no sense a center of gravity. In determining the median point, distance is not taken into account and the location of the units of population is considered only in relation to the intersecting median lines—as being north or south of the median parallel and east or west of the median meridian. It is evident that extensive changes in the geographical distribution of the population may take place without affecting the position of the median point. In this respect the median point differs essentially from the center of population, which responds to the slightest population change in any section of the country. To illustrate: since the median point lies east of Minnesota, a million persons could move from Minnesota to Oregon without affecting the median point, while the movement of 500 persons from one town in Indiana to another, across

[1] Charles S. Sloane, *Center of Population and Median Lines and Centers of Area, Agriculture, Manufactures, and Cotton*, Bureau of the Census, Washington, 1923, p. 5.

> the north and south line passing through the median point, would change the location of the point. On the other hand, a movement of a million persons from Minnesota to Oregon would have a very considerable effect on the center of population, since, in terms of the above analogy, the pressure exerted by each individual would increase in proportion to the distance travelled away from the center. *If all the people in the United States were to be assembled at one place, the center of population would be the point which they could reach with the minimum aggregate travel, assuming that they all travelled in direct lines from their residence to the meeting place. No such statement holds of the median point.*[1]

The portion of this quotation given in italics is also found in the same words and the remainder of it in substance in Volume 1 of the census,[2] and in the *Statistical Atlas*.[3]

At another point in the special bulletin just quoted is found the following statement, in a discussion of the centers of population of the different states:[4]

> In only nine states are the centers of population near the state capitals. The nine states are Arkansas, Delaware, Indiana, Missouri, Montana, New Hampshire, Rhode Island, South Carolina, and Vermont. *As the center of population is the point from which all the population is supposed to be equidistant, if it were necessary to assemble all the inhabitants of a state at one place, each individual to travel in a direct line from his residence to the meeting place, the center of population is the point they could all reach with the minimum aggregate of travel.*[5]

Essentially the same statements, as quoted in italics, are also found in the Thirteenth Census (1910).[6]

That this method of characterizing the center of population is not limited to official census publications is shown by its appearance in at least three widely used books in the field of sociology.[7] Doubtless it is also to be found in others. Munro and Ozanne in their text on *Social Civics* state that:[8]

> By the center of population is meant the point which the greatest number of people could reach with the least amount of travel.

Another well-known text book states that:[9]

> The center of population . . . is that point which could be reached with the minimum aggregate travel if all the people in the United States were to travel in direct lines to this one point.

[1] Italics are not in the original.

[2] Fourteenth Census of the United States, *Population*, 1920, Bureau of the Census, Washington, 1921, Vol. I, p. 32.

[3] *Statistical Atlas of the United States*, Washington, 1925, pp. 6, 13.

[4] Sloane, *op. cit.* p. 14.

[5] Italics are not in the original.

[6] Thirteenth Census of the United States, Vol. I, *Population*, 1910, Bureau of the Census, Washington, 1913, p. 45. Also *Statistical Atlas of the United States, 1910;* Bureau of the Census, Washington, 1914, p. 25.

[7] I am indebted to one of my students, Richard Benson, for the following three references.

[8] William B. Munro and Charles E. Ozanne, *Social Civics*, New York, 1922, p. 21.

[9] Ezra T. Towne, *Social Problems*, New York, 1916, p. 23.

A third, Lapp, quotes *in extenso* from the United States Census, including the minimum distance property under discussion in this paper.[1]

It cannot be denied that the form of statement used in the quotations in italics from the census gives a much more picturesque, vivid, and popular definition of the center of population than does the more abstract and mathematical definition of it as the centroid or center of gravity. But unfortunately it lacks one rather essential attribute—*truthfulness*. Before demonstrating its falsity, however, it may be of interest to consider a little further the history of the interesting point known as the center of population and of the closely related "median point."

The erroneous form of statement is not found in the 1900 census nor in any earlier ones, although treatment of the subject of center of population goes back to the ninth census, and even earlier in unofficial sources.

The "median point" was first computed for the 1900 census, at which time it was also computed for 1880 and 1890 for comparison. But official census recognition of the "center of population" was first given in the *Statistical Atlas of the United States* in 1874, compiled by Francis A. Walker, Superintendent of the Census and also Professor of Political Economy and History at Sheffield Scientific School of Yale College. In it he says:[2]

> The "center of population" is a theme upon which there has been much speculation among writers for the public press in the United States; and the subject is deemed to have enough at once of curious and of serious interest, to justify the introduction of this feature into the maps which exhibit the Progress of the Nation."

He defines the center of population as [3]

> The point at which equilibrium would be reached, were the country taken as a plane surface, itself without weight, but capable of sustaining weight, and loaded with its inhabitants in number and position as they are found at the period under consideration, each individual being assumed to be of the same gravity as every other, and consequently to exert pressure on the pivotal point directly proportional to his distance therefrom. In brief it is the center of gravity of the population of the country.

This is the first official definition of this point in any census publication. At the same time the position of the center of population was computed by counties for each previous census since 1790, except the

[1] John A. Lapp, *Practical Social Science*, New York, 1926, p. 17.

[2] *Statistical Atlas of the United States*, Based on the Results of the Ninth Census, 1870, Washington, 1874, Part II, "The Progress of the Nation," p. 5. [3] *Idem.*, p. 5.

sixth and seventh census years (1840 and 1850) which were taken from a table and map by Professor J. E. Hilgard of the United States Coast Survey, covering 1840 to 1870. These were published in the old *Scribner's Monthly*, the forerunner of the present *Century Magazine*.[1]

The falsity of the minimum-travel-distance property as stated in italicized quotations from the census and in the other works cited, is easily demonstrated by special cases with small populations.

(1) *The stated property, "minimum aggregate travel," is never true if the population is distributed non-uniformly along a straight line.* This can easily be shown with a population of only three, located at points on a straight line whose coördinates are (1, 0), (2, 0), and (15, 0). For this population the median point is (2, 0) while the center of population (center of gravity or centroid) is (6, 0). The total distance necessary to travel for a convention of the entire population held at the median point is only 14 while if it were held in accordance with the census suggestion at the center of population the total distance would be 18. If this population were located instead at (0, 0), (2, 0), and (100, 0) the aggregate distance to the center of population would be 132, to the median point only 100. The same property would hold if the population were distributed along any curve (*e. g.*, a railroad), if travel were also necessary along the curve. It is well known that for any *linear* distribution the sum of the deviations in absolute value from the median is a minimum. Proof and discussion of this well known property of the median are given in various books on statistics.[2]

(2) *The stated property is not true for certain distributions of a population over an area.* Consider, for example, the population of five located as follows: (0, 1), (0, −1), (2, 0), (14, 1), (14, −1), with center of population at (6, 0), and median point (2, 0). The total distance necessarily travelled in straight lines by this population in convening at their center of population is 32.290, as can be readily verified with the aid of a table of square roots. But if they decide to hold their convention at the median point the aggregate distance is only 28.555, a very considerable saving. If the first, second, fourth, and fifth points are moved to positions 9 instead of 1 above and below the

[1] J. E. Hilgard, "The Advance of Population in the United States," *Scribner's Monthly*, 4: 214 (June, 1872). For a discussion of Hilgard's interesting predictions in this article, fifty years after they were made, see Walter Crosby Eells, "The Center of Population—a Prophecy and Its Fulfilment," *The Scientific Monthly*, 20: 78–84 (January, 1925).

[2] See, for example, T. L. Kelley, *Statistical Method*, New York, 1923, p. 74; G. I. Gavett, *First Course in Statistical Method*, New York, 1925, p. 117; R. W. Burgess, *The Mathematics of Statistics*, Boston, 1927, p. 143; W. I. King, *Elements of Statistical Method*, New York, 1913, p. 128; C. J. West, *Introduction to Mathematical Statistics*, Columbus, 1920, p. 47; A. L. Bowley, *Elements of Statistics*, London, 1902, p. 126.

X-axis, the median point and center of population will remain unchanged. The aggregate distance to the center of population will be 49.716; to the median point, 48.439. If changed to 90, the aggregate distance to the center of population will be 365.109; to the median point, 361.637.

Due to the analogy with the proven property of a linear distribution, already mentioned, it might be inferred from the three examples just given that the sum of the distances to the median point is always less than that to the center of population. That even this is not the case, however, is shown by the next example. It would be true if all travel were rectangular, *i. e.*, along parallels of latitude or longitude, for this would involve only a double application of the known minimum distance property of linear distributions. But when the travel is radial (as the crow, or airplane flies!), it does not necessarily hold.

(3) *It is possible, but not probable, that the stated property may be true for certain selected distributions of a population over an area.* A distribution will now be exhibited in which the sum of the distances to the center of population is *less* than to the median point. This does not prove, however, that there may not be still another point, neither median or center of population, to which the aggregate travel might be still less. Consider the following population of 13: (0, 10), (0, 0), (2, 10), (2, 8), (2, 2), (2, 0), (4, 5), (8, 8), (8, 4), (8, 2), (9, 6), (10, 10), (10, 0). Their median point is (4, 5); their center of population (5, 5). The aggregate distance to the median point is 65.630, while to the center of population it is only 65.602. In this case it would be slightly better to hold the convention at the center of population than at the median point.

Enough examples have been given to show that the statements quoted from the census cannot, in general, be true. Probably they are never true, although the last example given prevents definite statement to this effect, at this point. As indicated later in this paper, the point of minimum aggregate travel, under certain conditions, with a changing location of population, is a fixed point although both center of gravity and median point are variable under such conditions. The fact seems to be that the minimum distance property is one quite independent of the properties of the center of gravity.

Nothing in this discussion should be construed as a criticism of the use of the center of population as a highly useful index of population movements. Probably no better way could be devised for summarizing compactly complex population changes. The writer himself has used it in educational studies and has strongly advised its use in other cases. It is too valuable a method to lose, but it is also too

valuable a method to be associated with such a false property of minimum distance for travel as has been the case for two decades.

It becomes an interesting matter, however, to consider for the United States what is the true point of minimum aggregate travel. Is it better to hold a convention at the center of population near Bloomington, Indiana,[1] or at the median point 121 miles northeast of Bloomington, or is there a third point, better than either? This general problem, which seems to be one of considerable complexity, is submitted for the consideration of other statisticians and mathematicians. The still more general problem is the determination for any distribution of a population of any size, of the point of minimum aggregate distance for travel, when all travel is in radial straight lines. The writer has had no success in the solution of this general problem. He has, however, worked out a special case for a population of three, located at the vertices of any isosceles triangle, which has surprising properties. It is quite likely that the general problem may only be approached through the solution of special cases.[2]

GENERAL SOLUTION OF A SPECIAL CASE

Let the population of 3 be denoted by A, B, C. Let B and C be located at the base vertices of an isosceles triangle of base $2a$, and

[1] Locations are as given by the 1920 census.

[2] I first became interested in the properties of the center of population in the spring of 1924 while on the faculty of Whitman College. I was asked by a committee on extension of one of the national fraternities to compute the center of population for men students in the colleges and universities of the country. This led me to a study of the methods of computation and properties of this point as given in the census publications. At the same time I was teaching the properties of the median to a class in statistical methods, which brought to my attention the error in the census characterization. Subsequently I published three articles dealing with various phases of the center of population; "The Center of Population—a Prophecy and its Fulfilment," *Scientific Monthly*, 20: 78–84 (January, 1925); "The Center of Population of Higher Education in the State of Washington," *Washington Education Journal*, 4: 77–79 (November, 1924); and "The Center of Population of Higher Education," *School and Society*, 24: 339–344 (September 11, 1926). When quoting from the census definition, however, I carefully avoided quotation of portions dealing with the "minimum-distance-for-conventions" property. I was aware of the fallacy at that time, but did not want to publish it without some constructive substitute to offer. Subsequent change of location caused me to drop the problem until recently although the greater part of the present paper was prepared four years ago. In discussing it with my colleague, Dr. W. E. Milne, he suggested that it had been worked upon by Professor F. L. Griffin, of Reed College. A letter to Professor Griffin brought the following reply, under date of June 2, 1929:

"Having read with much interest your article in the *Scientific Monthly* for January, 1925, I presently examined the census report in question, and noticed the erroneous statement concerning points of minimum travel. Two years later I reported the error to the American Mathematical Society, San Francisco Section, at its meeting at Vancouver, B. C., in June, 1927, and discussed the problem of determining the true point of minimum travel for a continuously distributed population, in a considerable number of special cases—with no idea that you had already given some attention privately to the fallacy. I am glad to learn of your paper and believe that our results will be mutually supplementary when both papers shall have been published. I have partially prepared my own results for publication, and will finish doing so as soon as I can adequately recheck some of them."

Subsequent to the preparation of my paper, I have been permitted to see Griffin's results. His method of approach is entirely different since it is based upon assumptions of "continuity" and "uniform or smoothly varying density" of population—an idealization of the fundamental census problem, which I conceive to be one essentially of discrete, irregularly distributed points.

altitude h. Let A be at the third vertex. Let P be the common meeting point. For minimum aggregate travel it is evident by symmetry that P is on the perpendicular bisector of the base. Let y be the sum of the three distances to P, which is x distant from the base. Then to reach P, B and C must each travel $\sqrt{a^2+x^2}$ and A must travel $(h-x)$. Then

$$y=(h-x)+2\sqrt{a^2+x^2} \quad \ldots\ldots \text{ if } (h-x)>0.$$

The first derivative $dy/dx=-1+\dfrac{2x}{\sqrt{a^2+x^2}}$.

This becomes 0 for $x=\dfrac{a\sqrt{3}}{3}=0.577\,a$.

That is, the distance of P from the base is a fixed point, quite independent of h. Thus A can take up his residence farther and farther distant on the perpendicular bisector of the base BC, and the optimum meeting place is unchanged, while the center of gravity changes for every change in A. It is, of course, always on the perpendicular bisector of the base, distant $h/3$ from the base. Call this distance g. Two simple examples will be illuminating.

(a) Let $a=4$, $h=9$, then $x=2.309$ and $g=3$. Distance to travel to center of gravity is then 16.000 while to P it is 15.928. The difference is slight, but in favor of P.

(b) Let $a=4$, $h=900$, then $x=2.309$ and $g=300$. Distance to travel to center of gravity is then 1200.053 while to P it is only 906.928, a substantial difference.

We next seek the condition under which P and the center of gravity will coincide. This will be true when $x=\dfrac{a\sqrt{3}}{3}=\dfrac{h}{3}$, *i. e.*, when $h=a\sqrt{3}$, which is the condition for the isosceles triangle to be equilateral. Thus the stated census property is true for a population of three located at the vertices of an isosceles triangle if, and only if, they are at the vertices of an equilateral triangle—a very severe restriction. It is interesting that the fixed point of meeting for the isosceles triangle population is at the center of gravity of this equilateral triangle, regardless of how far A travels away from the base beyond this point.

If however $h-x<0$, $x-h>0$ to keep the distance a real positive one. Then $dy/dx=1+\dfrac{2x}{\sqrt{a^2+x^2}}$ which obviously cannot be zero for any positive value of x, and there is no mathematical minimum to the function in this case. In this case, P and A coincide, and the optimum

meeting point is at A, *i. e.*, when $h \gtrless \frac{a\sqrt{3}}{3}$ it is more economical for B and C to travel directly to A, and the minimum distance travelled is $2\sqrt{a^2+h^2}$.

The significance of these results may be made clearer by a geographical illustration. Suppose three members of a national committee, residing at San Francisco, California, Columbia, South Carolina, and at a point a few miles east of Cleveland, Ohio, wish to have a committee meeting with the minimum travel expense. To insure direct radial travel, airplanes may be postulated! Then it turns out that the meeting point with minimum aggregate travel is at a point near Lexington, Kentucky. But the really surprising fact is that if the San Francisco member should change his residence to Tonopah, Nevada; to Ouray, Colorado; to Fort Scott, Kansas; or to Owensboro, Kentucky, this optimum meeting place for the three members would remain unchanged at the point near Lexington. But if the western member of the committee should move to any point in the latitude of San Francisco between Lexington and a point a little northwest of Richmond, Virginia, the situation would change entirely. He could then remain at home, invite the other two members of the committee to join him, and be assured that thereby a minimum amount of total travel for the committee would result.

A solution of the problem for a population of three at the vertices of *any* triangle would be of considerable interest as would other special cases for populations exceeding three.

EFFECT OF CONCENTRATION OF INDUSTRY ON SEASONAL VARIATION OF EMPLOYMENT

By Amy G. Maher

In 1921, the Ohio Council on Women in Industry made a study of unemployment in Ohio. This study revealed the fact that the large plants laid off a larger percentage of their workers than the smaller establishments: "It seems to be the policy of the larger producers to cease or greatly reduce production as soon as overproduction at the prevailing price is evident, whereas the smaller producers accept the reduced prices and continue to manufacture with little or no profit." In February, 1921, establishments employing 200 or more workers, had laid off, on the average, 43.85 per cent of their workers, whereas the establishments employing fewer than 200 workers had laid off only 15.2 per cent. These findings were later corroborated by the President's Conference on Unemployment.[1] Rapid concentration of industry into large units is so obvious that no illustration is needed to bring the fact home. In Ohio, in 1909, there were only 33 establishments employing over 1,000 workers; in 1918, there were 115 such establishments; 44 of these employed over 2,000 workers; 10, over 5,000; and five, over 10,000. These last all had very high percentages of lay-off in the 1921 depression.

It seems quite evident, therefore, that if larger units mean larger percentages of unemployed in the total wage-earning population, and if a tendency to very rapid concentration into ever larger and larger units is one of the outstanding phenomena of industry today, periods of cyclical unemployment will show a marked increase in severity.

What of seasonal variation? Has concentration an aggravating effect here, also? In communities which are becoming alarmed at their instability of employment, a conviction has been growing that those cities suffer least which have not "put all of their eggs into one basket." Is this conviction founded on fact? The Information Bureau on Women's Work has sought an answer to this question, or perhaps we should say, a hint to the answer, because only very meager data are available.

First, an effort was made to measure the comparative seasonal fluctuation in Ohio's eight largest industrial cities. Figures are avail-

[1] See *Business Cycles and Unemployment* published by the National Bureau of Economic Research, pp. 94 and 97. It was found that in the 1921 depression, the percentage change in actual hours worked, from peak to trough, was 3.08 for establishments employing 0–20 workers; 13.84, for establishments employing 21–100; 28.23, for establishments employing more than 100.

able for one year only, 1923, when they were published by the Ohio Division of Labor Statistics. The Division receives figures, by counties, showing the number employed on the fifteenth of each month. We computed, from these figures, the average number. If employment had been perfectly stable, this number would have been steadily at work throughout the year. But employment was not stable, and each month deviated from this average. After computing for each month the amount of this deviation, we then found the average deviation for the year, which is shown in the second column of Table I. But this number has significance in comparison, only in relation to the average number employed. Five thousand men out of work in Cleveland are a smaller percentage of the whole than two thousand in Youngstown. Therefore, we computed the ratio which this average deviation bears to the average monthly employment. This percentage is shown in the third column of the table. Ideally, this amount of available work in Cleveland would have kept 204,263 men steadily at work, throughout the year; but, instead, in any one month, more or fewer than this number were employed, and the amount of this deviation was, on the average, 5,672.17 men, or 2.78 per cent of the ideally stable number.

TABLE I

SEASONAL FLUCTUATION OF EMPLOYMENT IN EIGHT INDUSTRIAL CITIES OF OHIO, AS REPORTED TO THE OHIO DIVISION OF LABOR STATISTICS, FOR 1923

County	Average number employed per month	Average monthly deviation	Ratio of average monthly deviation to average number employed per month (Per cent)	Ratio of extreme deviation to average number employed per month (Per cent)
Hamilton County (Cincinnati)	117,135.35	2,233.25	1.91	8.27
Cuyahoga County (Cleveland)	204,263.00	5,672.17	2.78	11.82
Montgomery County (Dayton)	43,394.00	1,244.67	2.87	13.07
Stark County (Canton)	41,477.23	1,357.39	3.27	13.87
Franklin County (Columbus)	46,126.08	2,203.90	4.78	16.6
Lucas County (Toledo)	56,361.67	2,719.67	4.83	18.91
Mahoning County (Youngstown)	37,619.67	2,289.06	6.09	21.66
Summit County (Akron)	60,575.08	4,507.92	7.44	26.28

However, the serious social consequences involved are not expressed by this average deviation. It is the extreme spread of this deviation which is fraught with influences on community life—the spread from the greatest number reported for any month in the year, to the smallest number for any one month. Therefore we computed the greatest deviation from maximum month to minimum month during the year, and found what percentage it also bears to the average monthly employment. These percentages are given in the last column of the

table. An effort is made in the accompanying chart to picture the ratios of average and extreme deviation in these eight industrial cities.

It will be seen that the workers fare very differently, in this respect, in the various cities of the State. Cincinnati offers its wage earners by far the steadiest employment. Akron and Youngstown present the least favorable picture, with Toledo not far behind. If the worker could have a knowledge of these facts, and were free to choose his residence, he would do well to look for steady, year-round work in Cincinnati. The employer, likewise, could infer that industries in that city either have a steadier market, or dovetail their demands for workers, so as to produce less total fluctuation. A slight hint is given that the latter is the case, by underlining, in the Division's report, the maximum month of employment in the various industries in, for example, Cincinnati and Toledo: These lines will zigzag back and forth across the page, in the case of Cincinnati, whereas, in the Toledo figures, they cluster about certain seasons or months of the year. That is, in Cincinnati, the busy season in one industry much more often synchronizes with the slack season in another.

It occurred to us, therefore, that if a way could be found tc picture the extent of concentration in each city, it could then be studied in relation to the deviation of employment, as expressed in Table I. From the 1923 figures on employment, the following computations were made for each of the eight cities:

(1) Average total number of wage earners employed in manufacturing,
(2) Average number employed in the single largest industry,
(3) Ratio of (2) to (1).

These computations are given in Table II.

TABLE II

PERCENTAGE OF AVERAGE INDUSTRIAL EMPLOYMENT CONCENTRATED IN ANY ONE INDUSTRY, IN EIGHT INDUSTRIAL CITIES OF OHIO, AS REPORTED TO THE OHIO DIVISION OF LABOR STATISTICS, FOR 1923

County	Total average number in all manufacturing	Average number in largest industry	Average percentage in largest industry
Hamilton County (Cincinnati)	81,140.83	12,582.25	15.51
Cuyahoga County (Cleveland)	144,070.50	26,571.33	18.44
Stark County (Canton)	34,291.42	7,371.75	21.50
Montgomery County (Dayton)	32,326.08	7,004.25	21.67
Franklin County (Columbus)	26,660.58	6,138.17	23.02
Lucas County (Toledo)	41,131.00	13,903.92	33.80
Summit County (Akron)	51,347.17	36,934.17	71.93
Mahoning County (Youngstown)	30,008.92	21,691.58	72.28

In considering these data, it is simpler, perhaps, to return to the figure of the basket of eggs: They show, for example, that 15.51 per cent was the largest share of its employment that Cincinnati had entrusted to any one industry, in this case foundry and machine shops; Cleveland had entrusted 18.44 per cent to this, also its largest industry; Columbus, 23.02 per cent; Canton, 21.50 per cent; Dayton had entrusted 21.67 per cent of its total industrial employment to the calculating machine industry; Toledo, 33.80 per cent to the manufacture of automobiles and parts; Akron, 72.28 per cent to the manufacture of rubber tires and tubes; [1] and Youngstown, 72.28 per cent to steel and rolling mills.

Do these percentages bear any relation to the ratios of deviation of employment, in Table I? Table III, where they are brought together in parallel columns hints that they may.

TABLE III

PERCENTAGE OF AVERAGE NUMBER OF WAGE EARNERS EMPLOYED IN SINGLE LARGEST INDUSTRY, AND RATIOS OF EXTREME DEVIATION OF EMPLOYMENT IN EIGHT INDUSTRIAL CITIES OF OHIO, AS REPORTED TO THE OHIO DIVISION OF LABOR STATISTICS, IN 1923

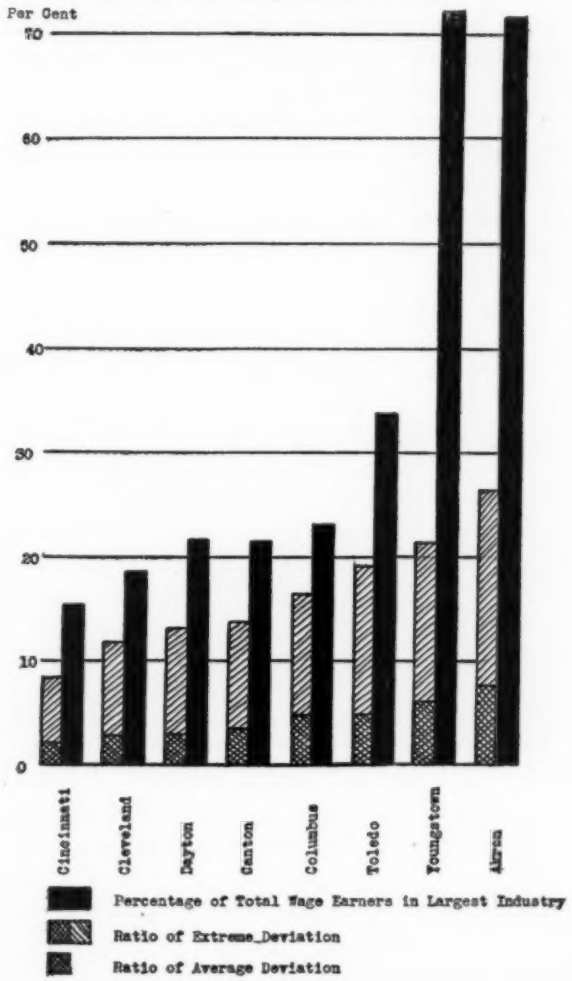
County	Percentage of average number of wage earners in largest industry (Per cent)	Ratio of extreme deviation of employment (Per cent)
Hamilton County (Cincinnati)	15.51	8.27
Cuyahoga County (Cleveland)	18.44	11.82
Stark County (Canton)	21.50	13.87
Montgomery County (Dayton)	21.67	13.07
Franklin County (Columbus)	23.02	16.60
Lucas County (Toledo)	33.80	18.91
Summit County (Akron)	71.93	26.28
Mahoning County (Youngstown)	72.28	21.66

It will be seen that in only two instances does the order in the second column differ from that in the first: Although Dayton has a slightly larger percentage of its wage earners in one industry than has Canton, its employment deviation is somewhat less; and although Youngstown has a larger percentage than has Akron in any one industry, its instability is somewhat lower. Without studying similar data over a period of years, we cannot know how far these two exceptions are accidental, so that they might disappear over a longer period of time. Many factors, not yielding to measurement, enter, of course: In two different cities, the concentration may be equal, but the largest industry in the one may be much more seasonal, in itself, than in the other; the smaller industries may show great concentration in one city and not in

[1] In 1928, this had grown to 83.53 per cent.

another; the busy time in the smaller industries in one city may synchronize with the busy time of the largest industry, whereas they

COMPARISON OF DEVIATION OF EMPLOYMENT AND CONCENTRATION OF EMPLOYMENT, IN EIGHT INDUSTRIAL CITIES OF OHIO, AS REPORTED TO THE OHIO DIVISION OF LABOR STATISTICS, FOR 1923



may dovetail, in another city.[1] However, these two exceptions do not preclude the possibility that there may exist a causal relation between

[1] It would be interesting to study the relation of monopoly to seasonal variation. We think it would have no effect on stabilising employment in the case of cyclical fluctuation even if the market for the product were inelastic, because the monopoly would not be willing to buy raw materials or labor on a falling market; but this does not *necessarily* mean it would not stabilize seasonal employment.

concentration and seasonal variation. We therefore computed the Pearsonian coefficient of correlation between the two columns of percentages in Table III, and were nevertheless surprised to find it so extremely high, being .903.

Of course, it would be very erroneous to lay too much stress on these arithmetical measurements of data for one year; we cannot *prove* any causal relation. Nevertheless, so high a correlation as that represented by the coefficient .903 seems to indicate that there is a decided tendency for much seasonal unemployment to exist in those cities where a large proportion of the industrial wage earners are concentrated in one large industry, just as it is now rather well established that we must expect to find cyclical unemployment increasing in severity as the concentration of industry into large units proceeds.

THE WAGES OF DOMESTIC LABOR IN CHICAGO, 1890–1929

ALICE C. HANSON AND PAUL H. DOUGLAS, *The University of Chicago*

The two groups of workers for whom there is little historical material on the movement of wages are (1) domestic workers and (2) salespeople. This article attempts to throw some light upon the relative fortunes of the former group by showing the wage rates which have been offered to them during the forty years 1890–1929 in Chicago. Since the wage contract between domestic servants and their employers is in the main struck individually and in the homes, it is impossible to obtain a continuous record of the rates which were finally agreed upon. It is, however, possible to secure from the newspaper advertisements a record of the wages offered, and while these may be somewhat below the rates which are finally accepted by both parties, it is believed that any such error would be relatively constant throughout the period and would not seriously impair the validity of the relatives of money and real earnings.

It was decided to confine the study to the wage rates offered in newspaper advertisements for white, experienced females to do general housework who were also expected to live at the place of employment. Colored help were not included, nor were those for such special types of work as "cook and laundress," "cook and first floor work," "upstairs work and care of children." Second maids and butlers were also barred.

The files of the *Chicago Tribune* were used for the principal source, eked out by the *Daily News*. The issues studied in each year were those of Sundays in the spring months, the months of March and April being used from 1898 on, with the exception of 1914 when May and June were used and 1916 when April alone sufficed. For the years 1890–98, when there were relatively few such advertisements, in order to secure an adequate sample, it was necessary to include every Sunday for six months.

The number of such advertisements covered is shown for each of the years in Table I. In all, 3,442 wage offers were collected. The smallest numbers obtained in any one year were 37 for 1929, and 41 for 1924.

Where a moderate range in rate offered was indicated, as for example from $8.00 to $10.00 a week, the higher rate was selected, in the belief that if the maid were white and experienced and knew that a higher rate could be obtained, she would in all probability get it. In a very few cases, where the spread was as much as $5.00, the half-way point

was selected. It should, of course, be realized that all rates which happened to be quoted in monthly terms, were reduced to their weekly equivalents.

The median and modal rates were computed as well as the mean, and while they are not printed because of lack of space, they were found to lie fairly close to the mean, with the median, as might be expected, nearer to it than was the mode.

TABLE I

THE MOVEMENT OF THE MONEY AND REAL WAGES OF DOMESTIC SERVANTS IN CHICAGO, 1890–1929

Year	(1) Number of cases	(2) Average weekly wage	(3) Relative weekly wage 1890–99 = 100	(4) Relative weekly wage 1914 = 100	(5) Relative cost of living 1890–99 = 100	(6) Relative cost of living Dec. 1914 = 100	(7) Dec. 1914 Chicago = 100	(8) Relative Real earnings 1890–99 = 100	(9) Relative Real earnings Dec. 1914 (U. S.) = 100	(10) Dec. 1914 (Chicago) = 100
1890	68	$3.82	95	54	104			91		
1891	56	4.15	103	59	101			102		
1892	65	4.23	105	60	102			103		
1893	81	4.50	111	64	100			111		
1894	77	3.99	99	57	97			102		
1895	99	4.16	103	59	97			106		
1896	152	3.83	95	55	99			95		
1897	62	3.60	89	51	100			89		
1898	51	4.12	102	59	100			101		
1899	86	4.08	101	58	102			99		
1900	118	4.28	106	61	106			100		
1901	113	4.40	109	63	108			101		
1902	133	4.57	113	65	111			102		
1903	146	4.93	122	70	116			105		
1904	81	5.10	126	73	115			110		
1905	76	5.07	125	72	115			109		
1906	146	5.36	132	76	119			111		
1907	143	5.77	143	82	126			113		
1908	55	5.60	138	80	121			115		
1909	100	5.68	140	81	121			116		
1910	113	6.16	152	88	128			119		
1911	82	6.41	159	91	132			120		
1912	90	6.64	164	95	133	Ave. March and April		123	Ave. March and April	
1913	70	6.68	165	95	137			120		
1914	138	7.03	174	100	139			125		
1915	46	6.14	152	87	135	98	100	113	89	88
1916	64	7.08	175	101	145	106	111	120	93	91
1917	104	7.63	189	109	169	124	129	111	88	84
1918	79	8.40	208	120	205	150	158	101	80	76
1919	114	10.50	259	149	236	172	200	110	87	75
1920	140	14.05	347	200	287	210	250	121	95	80
1921	63	14.83	366	211	251	183	205	146	115	103
1922	81	12.77	315	182	228	167	177	139	109	103
1923	85	14.84	367	211	231	169	179	159	125	118
1924	41	15.00	371	213	233	170	179	159	125	119
1925	47	14.06	347	200	236	173	179	147	116	112
1926	47	14.55	360	207	242	177	180	149	117	115
1927	45	14.27	352	203	236	173	178	149	117	114
1928	48	13.98	345	199	234	171	178	148	116	112
1929	37	13.32	329	190						

Table I combines all the data showing respectively: (1) the number of cases studied in each year, (2) the arithmetic mean of the weekly wages, (3) the relative indexes of these money rates in terms both of the

decade 1890–99 and of 1914, (4) the indexes of the relative cost of living during this period with the same years used as points of reference, (5) the indexes of the real earnings of the domestic workers.

The average money rates were, therefore, 74 per cent higher in 1914 than they had been during the nineties, and after falling in 1915 and rising again in 1916 to one per cent above their 1914 level, they then doubled in the ensuing four years. The rates failed to break in 1921 but did sag downwards by about 14 per cent in 1922. They rose again in 1923, however, and remained on approximately this level until 1926, when they once more began to decline, ending the period in 1929 with a relative 229 per cent higher than the 1890–99 base and 90 per cent above that of 1914.

But in order to obtain the relative purchasing power of these wages, it is necessary to divide the relatives by the relative movement of the cost of living. For this purpose, we have used for the years 1890–1914 the index which has been compiled by one of the authors.[1] For the years 1914–1929, we have used both (1) this index and (2) another computed especially for Chicago. This is based on the periodical surveys of the United States Bureau of Labor Statistics for that city, but instead of taking the average for all of the groups, including food and housing (which are provided for the domestic servants), we computed a weighted average for clothing and miscellaneous expenditures. The indexes for the months intervening between the periodical surveys were found by a process of interpolation, using the monthly index of the cost of living for the country as a whole which was computed by one of the authors. The assumption made was that differences in the rate of change over a period between the country-wide index and that of Chicago were evenly distributed and the country-wide index was adjusted accordingly. From 1915 on, in both of these series, the average for March and April rather than for the year as a whole was taken.

It will be seen from columns (6) and (7) that the index for Chicago rose more rapidly than that for the country as a whole during the period 1915–28, and it is, therefore, possible that the index for the period 1890–1914 is somewhat too low.

The following conclusions therefore emerge: (1) The real earnings of domestic servants increased during the fifteen years from 1900 to 1914, and in the latter years they were approximately 25 per cent more than they had been during the nineties. This was 18 points more than the gain in the real annual earnings of the employed workers.[2] (2) From 1914 to 1918 real earnings fell, being 20 per cent less in the latter year

[1] See Paul H. Douglas, *Real Wages in the United States, 1890–1926*, Ch. 2.

[2] *Cf.* Douglas, *op. cit.*

than they had been in the former if the country-wide index of the cost of living is used, and 24 per cent less if the Chicago index is used. (3) The real movement in 1919 is somewhat obscured by the more rapid increase of the Chicago cost of living index. If this is used, there was a further drop of 1 per cent in the real wages, but if the nation-wide index is used, there was an increase of 7 points and 8 per cent. The former is probably more nearly correct. Real earnings were therefore probably then slightly below the level of the nineties. (4) Real earnings increased during 1920 and 1921, being 28 per cent higher in the latter year than in 1919. There was a further increase in 1923 to a point which was 25 per cent above 1914, if the country-wide index of living costs is used as the divisor, and 18 per cent above if the Chicago index is so used. (5) Real earnings, however, fell off by 6 per cent in 1925 and since then have remained relatively constant. In 1928, according to the United States index of the cost of living, they were 48 per cent above 1890–99 or a 13 per cent greater gain than that made by labor as a whole and 16 per cent above 1914, which was a smaller increase than the rest of labor had obtained in this period. In terms of the Chicago index, the increase over 1914 was only 12 per cent, which was of course still less.

It should also be added that domestic servants have also gained during this period through a lessening in the severity of their tasks. Washing and laundry-work were expected of the general housemaid during the nineties, but this is no longer required in the vast majority of households which keep servants.

It is not pretended that the results for Chicago are necessarily the same as those which might be obtained for other cities, but it is hoped that studies may be launched for other cities which will enable us to close one of the glaring gaps in our statistical record of wage movements.

STOCK PRICE INDEXES OF THE NEW YORK CURB EXCHANGE

By Leonard Kuvin, *Index Number Institute*

The New York Curb Exchange has in recent years come to be appreciated as the second largest security exchange in the world. It is held by some to be larger than any of the foreign stock exchanges.

While security price indexes have for many years been calculated for the New York Stock Exchange, none have until recently been constructed for the curb. To meet the current demand for these additional security price indexes, Professor Fisher and his organization, the Index Number Institute, have lately set themselves the task of constructing curb price indexes. They include the movements of industrials, as a whole and in sub-groups, and utilities.

Stock prices on the curb have been found to move differently than those on the big board. No doubt there are reasons. Among them is the one reason of difference in the grade of securities; another is a difference in industries supporting these securities; still another is the attitude of the investing and speculating public toward curb security values.

For all these reasons owners of securities on the curb have in the past been in need of index numbers measuring, on the average, their specific movements. These indexes, presently constructed and published by Professor Fisher, serve a distinct and unique purpose.

But, in accepting them the investor must of necessity familiarize himself with the technicalities of their construction. This article describes the several typical problems of index number work and reveals the results obtained.

SELECTION OF STOCKS

One hundred common industrials were selected to represent the movements of the various common industrials, while fifteen were selected to represent the movements of public utilities. Altogether one hundred fifteen stocks are employed to measure the movements of all stocks on the curb.

These stocks were selected from the 490 listed on the New York Curb Exchange during the first week in January, 1929. Though the total number of stocks selected represent less than one-quarter of those listed, their movements may be expected to describe properly the movements of all.

The basis of selection of these stocks was their individual values outstanding with reference to the total amount outstanding of their various groups.

Twelve groups were found to contain almost all the major sub-divisions of industries into which stocks may naturally be classified. They represent broad basic categories of curb exchange financing, though they are in some measure arbitrary.

Indexes were constructed for industrial common stocks and for public utilities. Sub-indexes were computed for twelve groups of common industrials, namely:

Oils
Auto Accessories
Motors
Steel and Iron
Copper and Mining
Foods and Sugar
Stores
Chemicals
Machinery and Railroad Equipment
Radio and Theatres
Aviation
Other Industrials (miscellaneous)

Upon classification of all the 490 stocks into their various groups, the total values outstanding in each group were computed. Prices of each stock during the first week of January, 1929, were multiplied by shares outstanding and aggregate values of each group were obtained.

The one hundred industrials were then chosen so that their values outstanding approximated 78 per cent of the total value of all industrials outstanding. (See Table I.) They were the one hundred largest

TABLE I.

Groups	No. of Stocks Listed		Values Outstanding ($-0000) Jan. 4, 1929		Percent Value Selected	Percent of Total Value Outstanding				Value Outstanding
	Total	Selected	Total	Selected	Total	All Indust. Total	All Indust. Selec.	All Stocks Total	All Stocks Selec.	total Selected
Oils	61	7	451167	357734	79.3	33.5	26.6	26.2	20.8	1.261
Auto Accessories	14	5	16637	13325	80.1	1.2	1.0	1.0	.8	1.248
Motors	7	4	10260	7115	69.3	.8	.5	.6	.4	1.443
Steel & Iron	3	3	5364	5364	100.0	.4	.4	.3	.3	1.000
Coppers & Mining	46	8	187952	139919	74.8	13.9	10.4	10.9	8.1	1.337
Foods & Sugars	53	10	19730	13262	67.2	1.5	1.0	1.1	.8	1.488
Stores	45	7	72558	51647	71.2	5.4	3.8	4.2	3.0	1.404
Chemicals	14	4	108570	93364	86.0	8.1	6.9	6.3	5.4	1.163
Machinery & R.R. Eqpt.	19	7	23025	18253	79.3	1.7	1.4	1.3	1.1	1.261
Radio & Theatres	12	5	17551	14625	83.3	1.3	1.1	1.0	.9	1.200
Aviation	14	6	18424	14873	80.7	1.4	1.1	1.1	.9	1.239
Miscellaneous	178	34	416375	327050	78.5	30.8	24.2	24.2	19.0	1.274
All Industrials	446	100	1346813	1056531	78.4	100.0	78.4	78.4	61.5	1.276
Public Utilities	44	15	372082	286360	77.0			21.6	16.7	1.299
All Stocks	490	115	1718895	1342891	78.1			100.0	78.2	1.280

issues from the standpoint of values outstanding at that time. They were selected from the stocks ranged in the various groups so that the individual selections, when arranged in groups and totaled, would yield a percentage of the group value outstanding approximately equal to 80 per cent. In other words, the stocks selected to represent oils yielded a percentage of value outstanding of all oils outstanding equal to 79.3 per cent early in 1929. Similarly the percentage of selected values outstanding of the total in the auto accessory group equaled 80.1 per cent. In the steel and iron group the stocks selected were all of the stocks available; in other words, the selected value was 100 per cent of the total value outstanding.

It was difficult to obtain uniformity of percentages in all groups because of the variation of distribution of capital values in the categories decided upon. The accompanying table, in addition to showing the number of stocks selected in each group and the percentages of their values outstanding as compared with the total value, shows the percentages which total values of the various groups bear to the total values of all industrials and of all stocks, together with the percentages which the selected stocks bear to the value outstanding of all industrials and all stocks.

The stocks decided upon and presently employed to represent various groups are listed as follows:

Oils (7)
- Gulf Oil of Pa.
- Humble Oil and Ref.
- International Pet.
- Ohio Oil
- Stand Oil of Ind.
- Stand Oil of Ky.
- Vacuum Oil

Coppers and Mining (8)
- Aluminum Co. of Am.
- Cons. Copper Mines
- Glen Alden Coal
- Hudson Bay Min. & Sm.
- Newmont Mining
- New Jersey Zinc
- Noranda Mines
- Teck-Hughes Gold Min.

Stores and Retail Dis. (7)
- Butler Bros.
- Crowley Milner
- Lit Bros.
- Newberry
- Penney (J. C.)
- Richman Bros.
- Walgreen Co.

Radio and Theatres (5)
- Balaban & Katz
- Fox Theatres Cl. A
- Grigsby-Grunow
- Hazeltine Corp.
- Zenith Radio

Miscellaneous (34)
- Alpha Port Cement
- Amer. Investors
- Armstrong Cork
- Atlas Port Cement
- Blumenthal
- Caterpillar Trac.
- Celanese Corp.
- Cons. Auto Mdse.
- Deere & Co.
- Firemen's Fund
- Goldman Sachs
- Insurance Co. of N. A.
- Inter. Shoe
- Massey Harris
- Libby O Sh. Glass
- Niagara Shares
- Parafine Co.
- Pitts. Plate Glass
- Pitts. Screw & B.
- St. Regis Paper
- Schulte Real Estate
- Selected Industries
- Sherwin Williams
- Smith A. O.
- Stetson (J. B.)
- Taggart Corp.
- Tishman Realty & Con.
- Trans. Amer. Co.
- Tub Artif. Silk B
- United Piece Dye
- U. S. Foil Co. B
- U. S. Freight of Del.
- U. S. Gypsum
- Walker (Hiram)

PUBLIC UTILITIES (15)
Amer. Gas & Elec.
Amer. Lt. & Trac.
Amer. Superpwr.
Asso. Gas & Elec.
Buff. N. & E. Pwr.
Cities Service Co.
Commonwealth & Southrn.
Elec. B. & S. Sec. Corp.
Elec. Investors
Middle West Util.
Mohawk Hudson Pwr.
North East Pwr.
North States Pwr.
Rochester Cent. Pwr.
United L. & P. A.

AUTO ACCESSORIES (5)
Budd (Edw.)
Firestone T. & Rubber
Hood Rubber
Lakey F. & M.
Seiberling Rubber

STEELS AND IRON (3)
Camp. Wy. & C. Fdy.
Mesabi Iron
Wheeling Steel

CHEMICALS (4)
Anglo Chil. Nitrate Consol.
Colgate P'olive Peet
Parke Davis
Proctor & Gamble

AVIATION (5)
Aviation Corp. of Am.
Bellanca Aircraft
Douglas Aviation
North Am. Aviation
Universal Aviation

MOTORS (4)
Check. Cab Mfg. A
Durant
Para. Cab Mfg.
Stutz Motor Car

FOODS AND SUGARS (11)
Cons. Dairy Prod. Inc.
Fajardo Sugar
General Baking
Mavis Bottling
Mead Johnson
Nat'l Sugar
Seeman Bros.
U. S. Dairy A
Wheatsworth
Widlar Food Prod.
Williams R. C. Oil

MACHINERY AND R. R. EQPT. (7)
Bliss Co.
Draper Corp.
Gotham Knitbac Mach.
Int. Cigar Mach.
Niles Bem. Pond
Safety C. H. & L.
Superheater

FORMULA AND DATA

The method of arriving at indexes of price is, in simple, to compare the value at any period of time of the shares outstanding of the stock selected with an average value of the same selection throughout the year 1926.

The ratio of the former to the latter, when multiplied by one hundred, furnishes the price index at a particular time of the group of stocks so treated.

The formula thus used is the weighted aggregative formula in which the weights represent shares outstanding. In the case of these indexes the weights were taken to be shares outstanding on or about January 1, 1929.

Algebraically expressed the weighted aggregative formula is $\frac{\Sigma qp_1}{\Sigma qp_0}$. This formula, when reduced to another form, is equivalent to $\frac{\Sigma qp_0 \frac{p_1}{p_0}}{\Sigma qp_0}$. It can be seen from this form that the weighted aggregative formula is one wherein price ratios of individual stocks, referring price at any time, p_1, to the price for the base period, p_0, are multiplied by the values of the individual stocks at the base period and summed to provide an aggregate of such products. This aggregate is then divided by the

sum of these values. The result is in effect a weighted average of price relatives in which the weights of stocks approximate capital values outstanding at the base period.

Strictly speaking, the use of shares outstanding at a period of time, not the base period, as in this case the base period is 1926 while the shares outstanding are as of January, 1929, causes the formula employed to differ in its exact form from the purest form of weighted aggregative in which the weights are values of shares outstanding at the base period.

However, the results obtained by the use of such hybrid weights are sufficiently close to those obtainable with the use of base period weights to warrant the convenience of employing quantities or shares outstanding applicable to the present. For future use such weights will more adequately express relative importance than will weights strictly measuring shares outstanding during the base period. In actual computation the weights were round numbers representing hundreds of thousands of shares while prices used in conjunction with them were averages of the nearest dollar at any period of time.

The monthly indexes save for the months of 1929 were not averages of daily or weekly indexes. They were obtained outright by using prices measuring, on the average, conditions for the months. The price of any stock for any month was taken to be an average of the first and last and the high and low for the month as obtained from the *Commercial and Financial Chronicle* or the *Annalist.*

In arriving at an index of all industrials cognizance was taken of the differing percentages borne by the various selections of the total values outstanding in their respective groups.

Before adding the aggregates of the groups together to form a total industrial aggregate, the sub-totals were individually inflated so that they could be combined to produce the grand aggregate of industrials stressing each selection as though it represented the whole of all stocks in its particular group.

To do this it was necessary to assume that the values selected in their relation to the values outstanding of the various groups was constant throughout. The alternative to such assumption would involve recomputing the percentages periodically throughout 1926, 1927 and 1928 in order to inflate the group aggregates more correctly throughout this interval. It was considered, however, that the additional accuracy thus obtained was not sufficient to warrant the extra work.

Accordingly, reciprocals of the percentages of selected values to group values outstanding the first week of January, 1929, were obtained and used throughout the interval to inflate the various group

aggregates measuring the price movements each month. (See Table I.) These inflated group aggregates were added together to produce an all industrials group aggregate which was then referred to its 1926 average to yield index numbers throughout the interval.

The inflated aggregate value of selected common industrials was then compared with a similarly inflated aggregate value of public utilities at various points of time to yield, in totaling, an aggregate value measuring prices of all stocks on the curb. These aggregates, when referred to 1926 average, yielded index numbers of price of all stocks listed on the curb exchange.

RESULTS

The accompanying charts picture the relative movements of stocks on both New York Exchanges. Table II provides data of the curb indexes.

Comparing the movements of all industrial common stocks on the curb and on the big board we find that movements on the curb were somewhat more intense than movements on the stock exchange. Taking 1926 as an average and equal to 100, prices of all industrials on the curb moved up to 226.7 in June, 1929, 238.5 for the month of July, and 228.2 for the month of September, 1929. During that same period of time all industrial common stocks on the big board moved to 182.8 for the month of June, 194.1 for the month of July and 207.1 for the month of September, 1929. The swings of both groups of stocks were in some respects very similar, although the gap between the two indicates the higher degree of price activity manifested by industrial common stocks on the curb.

Public utilities moved from a level of 100 in 1926 to a level of 360.3 for June, and an average of 501.4 for July and 535.5 for September, 1929. At the same time public utilities on the big board moved to a level of 185.7 for June, 215.9 for July and 259.1 for September.

The movements of oils on the curb very closely resemble the movements of similar stocks on the big board with the exception that upward tendencies on the curb were slightly more pronounced than were those on the stock exchange. The high point reached on the curb was 158.4 in February, 1929, as against a high point on the big board of 130.4 reached in September, 1929.

The auto accessories index for the curb registered at its highest point in April, 1929, at a level of 195.9. Prices rose steadily through 1927 until they reached a turning point of 171.0 in January, 1928, from which they receded to 132.3 in October, 1928, and resumed their upward course until April, 1929, where they registered at the highest point since the beginning of 1926. Prices on the stock exchange moved in a some-

what similar fashion throughout 1926 and 1927 with the exception that there was no high point in 1927 comparable with the one reached by the curb.

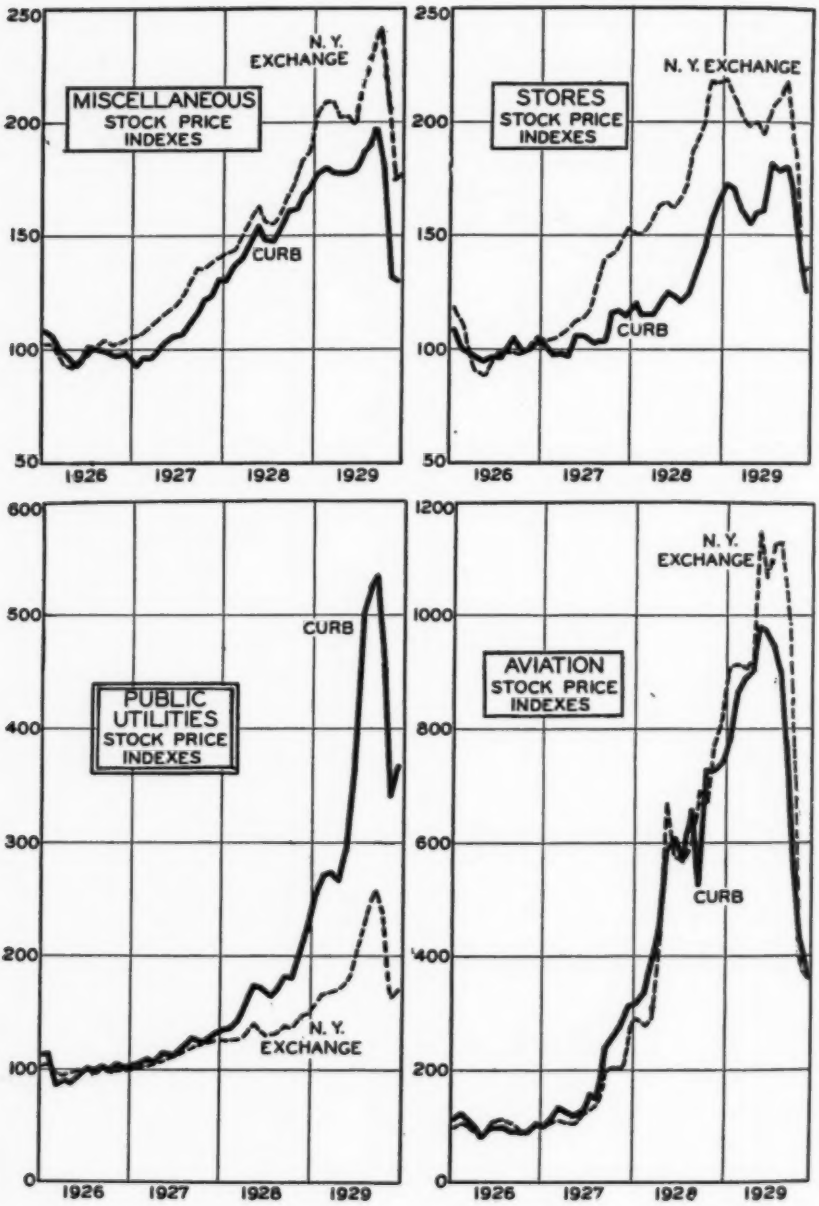
Motors on the curb moved differently from motors on the big board. The dissimilarity of stocks in the two indexes is largely, if not entirely,

TABLE II

PROFESSOR FISHER'S DAILY NEW YORK CURB PRICE INDEXES
Monthly Averages

Groups Dates	Oils	Auto Accessories	Motors	Steel & Iron	Coppers & Min.	Foods & Sugar	Stores	Chemicals	Machinery	Radio & Theatres	Aviation	Miscellaneous	All Industrials	Public Utilities
1926	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1927	107.2	114.1	92.8	92.9	111.1	125.2	105.2	138.6	125.2	71.5	176.4	109.1	113.3	116.7
1928	129.2	142.8	124.1	123.1	140.3	167.9	129.8	189.5	163.8	113.4	554.6	152.2	171.1	170.8
1926														
Jan.	108.1	114.1	143.4	103.1	92.1	80.7	109.1	96.7	97.5	147.4	114.1	108.9	109.5	112.8
Feb.	101.9	110.6	132.9	95.7	94.8	78.6	100.2	95.7	102.3	118.8	124.9	106.2	104.9	112.6
Mar.	96.3	101.6	97.7	84.6	87.7	93.2	98.6	91.6	96.8	95.0	108.7	100.3	96.0	86.5
Apr.	99.6	98.8	84.7	102.7	91.1	97.3	95.8	94.8	93.6	97.8	97.8	97.0	95.6	90.1
May	100.6	97.8	75.6	90.6	99.4	93.5	95.4	95.6	93.9	97.8	81.5	94.5	93.0	89.7
Jun.	100.2	104.3	71.6	88.6	103.2	100.2	97.3	93.3	96.0	97.8	97.7	96.3	95.4	96.4
Jul.	98.9	94.3	78.2	102.6	104.2	108.4	96.2	97.5	99.0	98.9	97.7	102.1	98.0	100.7
Aug.	99.7	94.0	115.9	107.5	107.0	110.9	99.2	103.4	101.6	97.8	97.7	100.7	103.2	100.6
Sep.	97.9	97.5	104.2	107.5	104.3	106.9	104.8	101.9	104.5	97.1	92.3	99.8	101.8	102.3
Oct.	97.5	98.1	117.2	102.6	104.8	104.8	99.7	105.1	104.4	86.3	92.3	97.9	101.3	101.0
Nov.	97.3	95.3	92.5	110.2	104.9	110.3	99.7	108.1	103.4	82.7	92.3	97.9	99.7	104.7
Dec.	101.8	93.5	86.0	102.6	106.3	115.3	104.0	116.3	107.1	82.7	103.1	98.5	101.5	102.6
1927														
Jan.	104.0	94.4	76.9	101.4	104.0	110.3	102.5	117.7	102.4	79.1	103.1	94.2	99.0	104.3
Feb.	102.8	99.1	71.7	93.8	104.3	114.6	97.7	113.4	112.4	79.1	114.0	96.8	99.7	107.6
Mar.	99.3	98.2	78.2	96.3	104.6	107.1	97.7	114.2	123.2	79.1	135.6	97.1	101.9	107.9
Apr.	98.8	94.7	112.0	99.9	103.7	105.2	96.5	119.6	122.5	64.7	124.8	101.6	103.5	108.3
May	102.9	104.9	95.1	92.1	106.9	113.0	105.5	134.7	122.6	64.7	119.4	103.4	105.4	113.7
Jun.	103.8	106.1	101.7	85.5	106.3	121.1	105.5	132.5	123.8	58.3	124.8	106.3	106.6	111.4
Jul.	105.5	108.7	85.0	98.7	111.0	130.9	102.7	140.8	121.0	66.5	157.4	107.3	110.7	114.2
Aug.	109.1	116.3	92.0	88.5	115.1	133.2	103.0	141.4	132.2	69.3	152.0	110.1	113.3	121.6
Sep.	109.6	123.8	111.5	91.1	116.0	137.0	103.5	159.9	138.5	73.6	238.8	115.5	124.8	128.4
Oct.	109.5	117.9	89.2	87.7	117.9	138.1	116.3	157.3	135.4	70.5	255.1	121.8	124.6	123.8
Nov.	119.7	134.8	100.3	82.2	120.8	147.0	116.9	163.9	132.5	73.6	276.7	123.7	130.9	127.6
Dec.	121.1	170.5	100.3	97.7	122.3	144.5	114.5	168.8	139.2	78.9	314.7	132.3	139.3	131.3
1928														
Jan.	121.7	171.0	90.8	95.2	124.1	159.3	119.7	172.7	144.3	75.9	320.0	131.2	141.2	136.6
Feb.	119.8	156.3	83.6	95.2	123.0	161.4	114.7	170.3	149.8	79.1	336.3	137.4	140.9	138.4
Mar.	118.9	140.0	91.7	91.2	123.3	162.7	115.1	171.8	148.6	82.6	401.6	140.2	145.1	143.1
Apr.	126.5	142.3	97.9	91.8	135.7	172.8	119.9	180.4	155.0	84.1	450.6	147.2	154.3	158.8
May	130.5	135.0	101.7	105.6	145.0	184.0	124.9	186.2	157.5	90.8	591.6	155.7	169.1	175.5
Jun.	125.0	131.8	111.8	108.7	145.2	178.8	122.9	193.3	156.5	96.0	608.2	150.0	170.4	172.2
Jul.	123.5	132.0	118.6	103.8	143.2	164.0	121.4	199.6	156.0	95.3	585.0	148.3	166.1	166.8
Aug.	125.2	133.8	125.7	131.9	143.4	165.8	123.7	197.8	159.3	111.1	662.7	152.8	177.4	170.7
Sep.	126.1	134.4	161.0	141.7	145.6	163.8	132.7	200.6	170.8	122.5	526.9	161.2	176.4	181.7
Oct.	131.8	132.3	183.2	156.1	143.6	163.7	143.2	198.0	174.5	159.2	727.6	162.8	197.2	181.4
Nov.	147.8	141.7	166.2	175.2	151.7	170.1	154.5	202.9	191.5	169.4	727.6	168.1	204.4	200.4
Dec.	153.5	165.0	156.6	180.6	159.5	169.9	164.7	200.7	201.4	194.2	737.1	171.5	211.3	222.5
1929														
Jan.	157.8	177.9	190.7	161.3	169.5	169.9	172.0	208.9	224.2	206.6	777.6	177.2	223.1	252.5
Feb.	158.4	175.6	203.8	165.0	175.1	169.4	170.4	233.2	230.9	212.6	865.5	180.2	233.8	273.0
Mar.	158.1	187.8	188.6	164.0	171.5	168.5	160.9	231.6	225.8	201.1	891.4	178.8	232.2	273.5
Apr.	144.0	195.9	177.8	161.9	178.8	141.9	155.1	225.1	215.2	183.2	902.1	178.8	225.9	268.3
May	142.0	194.0	150.3	146.5	180.4	137.4	159.0	222.1	207.0	176.6	977.0	178.0	225.4	294.9
Jun.	140.4	186.8	145.1	154.7	182.8	136.9	160.9	224.4	225.8	179.4	970.2	179.6	226.7	360.3
Jul.	137.8	180.3	163.1	164.8	216.1	139.0	161.9	240.5	233.9	231.5	945.6	167.2	238.5	501.4
Aug.	140.7	173.4	146.8	161.7	233.2	127.8	176.0	254.4	231.9	254.2	897.5	189.7	235.6	525.0
Sep.	141.9	165.8	147.8	163.2	229.5	129.3	180.4	252.5	233.1	255.3	773.3	198.7	228.2	535.5

responsible. Whereas motors on the curb registered their high of 204.9 in February, 1929, motors on the big board reached their highest of 292.7 in March. The downward tendency on both exchanges has been somewhat similar since those months.


MISCELLANEOUS
STOCK PRICE
INDEXES
N. Y.
EXCHANGE
CURB
250
200
150
100
50
1926
1927
1928
1929
STORES
STOCK PRICE
INDEXES
N. Y. EXCHANGE
CURB
PUBLIC
UTILITIES
STOCK PRICE
INDEXES
CURB
N. Y.
EXCHANGE
600
500
400
300
200
100
0
AVIATION
STOCK PRICE
INDEXES
N. Y.
EXCHANGE
CURB
1200
1000
800
600
400
200

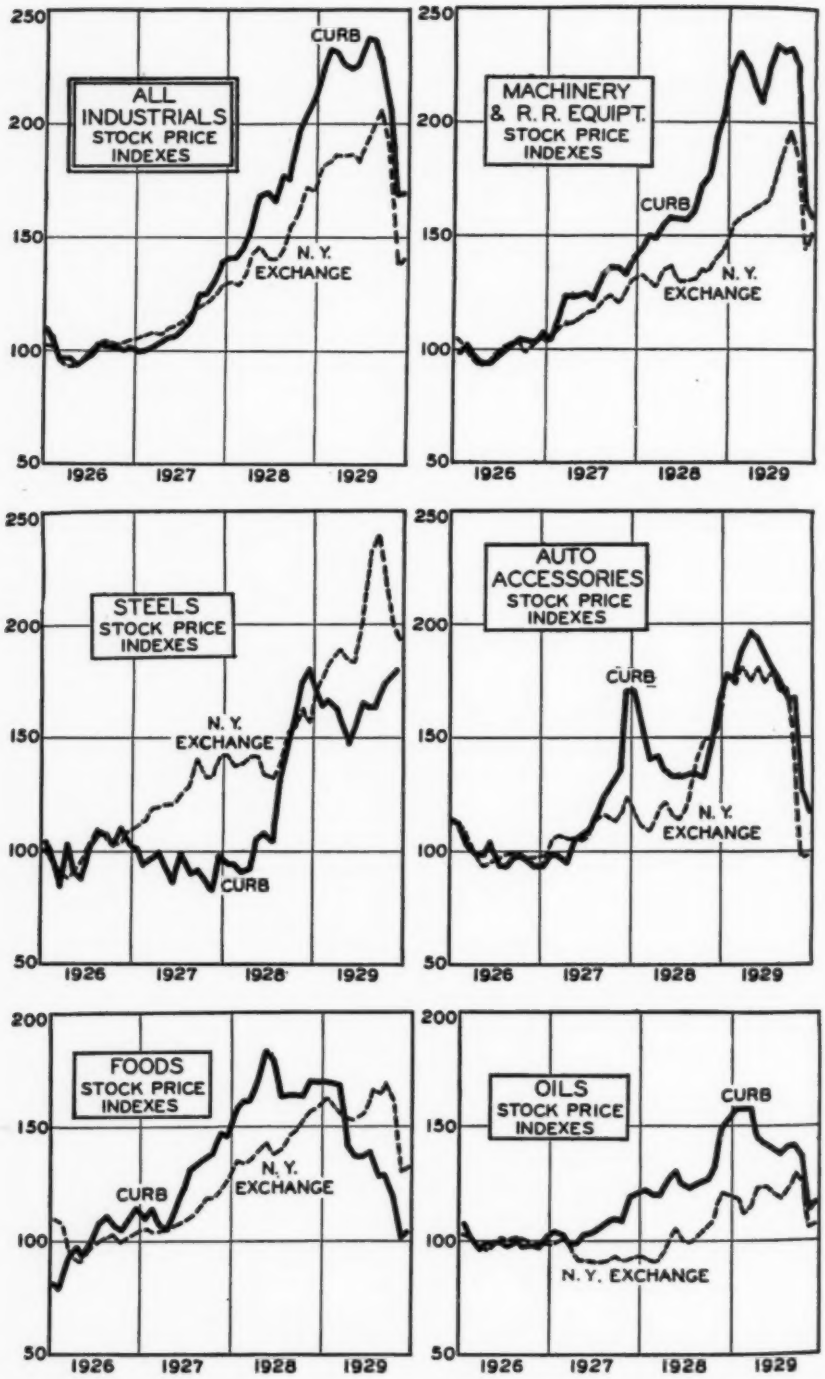
Steel and iron stocks on the curb showed different movements from those on the big board. Whereas curb stocks moved sidewise throughout 1926 and 1927 and the first half of 1928, similar stocks on the big board showed a steady upward course and continued upward throughout 1928 and the first half of 1929. Stocks on the curb began to catch up with those on the stock exchange in July, 1928, by moving sharply upwards in the subsequent months. The high point reached by stocks on the curb was 180.6 in December, 1928, from which time the movement has been downward. The high point reached on the big board was 239.1 in September, 1929, with little or no change since.

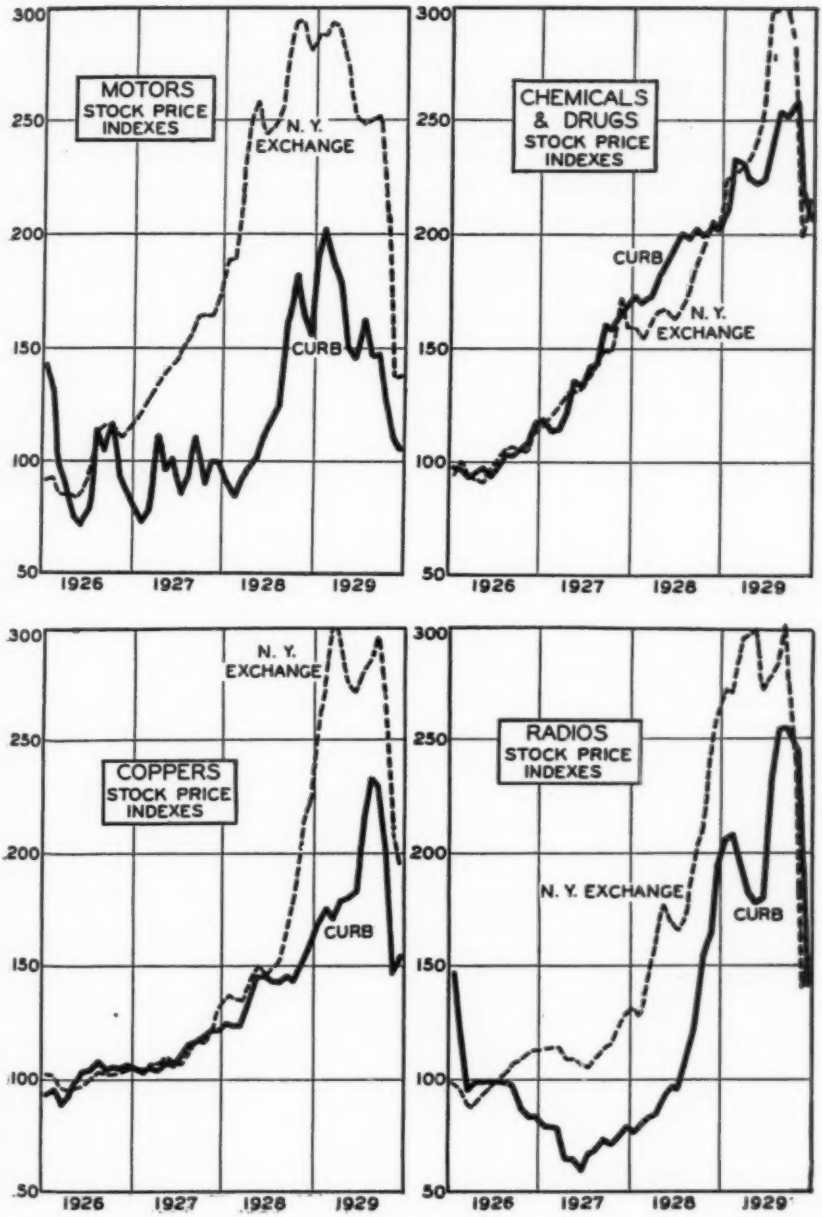
Copper and mining stocks on the curb showed a conservative and steady movement upwards since the beginning of 1926. Similar stocks on the big board closely paralleled movements of those on the curb up to June, 1928, at which time prices on the big board sky-rocketed upwards, reaching a high point of 313.0 in April, 1929. The highest point reached by copper and mining issues on the curb was 233.2 in August, 1929. Price movements on the curb for this class of stock might best be described as steadily upwards.

Foods and sugar stocks on the curb were much more volatile than were similar stocks on the big board. Upward movements of these curb stocks gained impetus since April, 1927, reaching a high point of 184.0 in May, 1928. The highest point reached by similar stocks on the big board was 169.3 in September, 1929. All upward movements on the curb were pronounced. The downward tendencies of foods and sugars on the curb became evident in January, 1929, when stocks steadily dropped downward at a rate of approximately 15 per cent between January and May.

Fluctuations of stores and retail distribution stocks were similar in both markets throughout 1926, 1927 and 1928. The one difference between the two movements was that stocks on the big board in this group showed more pronounced upward movements than did those on the curb. Taking 1926 as normal and equal to 100, the high point reached by stocks on the big board was 218.9 in November, 1928. Since then stocks on both exchanges have receded proportionately.

Chemicals on the curb moved very closely with chemicals on the big board. In both cases the trend was upward throughout 1926, 1927 and 1928, but continued in the early months of 1929 on the big board alone. The high point reached by chemicals on the curb was 254.4 in August, 1929, from which point prices receded gently since. With the exception of this movement in 1929 and slight lagging of prices in 1928 in their upward movement as compared with prices on the curb, movements of these two groups were very much the same.


ALL INDUSTRIALS STOCK PRICE INDEXES
CURB
N. Y. EXCHANGE
MACHINERY & R. R. EQUIPT. STOCK PRICE INDEXES
CURB
N. Y. EXCHANGE
STEELS STOCK PRICE INDEXES
N. Y. EXCHANGE
CURB
AUTO ACCESSORIES STOCK PRICE INDEXES
CURB
N. Y. EXCHANGE
FOODS STOCK PRICE INDEXES
CURB
N. Y. EXCHANGE
OILS STOCK PRICE INDEXES
CURB
N. Y. EXCHANGE
250
200
150
100
50
1926
1927
1928
1929


MOTORS
STOCK PRICE
INDEXES
N. Y.
EXCHANGE
CURB
CHEMICALS
& DRUGS
STOCK PRICE
INDEXES
CURB
N. Y.
EXCHANGE
COPPERS
STOCK PRICE
INDEXES
N. Y.
EXCHANGE
CURB
RADIOS
STOCK PRICE
INDEXES
N. Y. EXCHANGE
CURB
300
250
200
150
100
50
1926
1927
1928
1929

Machinery and railroad equipment stocks on the curb reached their high during February, 1929, at 231.2, receding to 225.9 in June and rising to 233.9 in July, 1929. Similar stocks on the big board rose, too.

Radio and theatre stocks on the curb had a varied course. Slumping to a low of 58.3 in June, 1927, they steadily regained from that time to attain a level of 208.3 in February, 1929, and slowly receded to allow of 176.6 in May, recovering and reaching a high of 255.3 in September, 1929. On the big board radio and theatre stocks gained steadily, reaching a level of 299.6 in May, 1929, receding to a low of 271.0 in June, and recovering to a level of 304.0 in September, 1929.

Aviation stocks on the curb moved along with airplane securities in the other market with the exception of a dip in the former which took place in September, 1928. During the early months of 1929 curb stocks paralleled stocks in the big market up to May, 1929, when they dropped off to a level of 773.3 in September, 1929.

Other industrial or miscellaneous curb stocks paralleled those on the stock exchange at a lower level throughout 1926, 1927 and 1928, but with a wider gap in 1929.

THE "IDEAL" FORMULA FOR "GENERAL PURPOSE" INDEX NUMBERS

By F. Gardiner Perry, *Babson Statistical Organization*, and
A. G. Silverman, *Massachusetts Institute of Technology*

In the discussion that has centered about the problem of the best formula for the calculation of price and quantity indexes, relatively little attention has been paid to the adaptability of this or that formula to its intended use and to the nature of the data to which it is to be applied. This problem was unavoidable in the preparation of an index of the physical volume of Canadian business,[1] where a considerable lack of homogeneity and the incompleteness of the data made unsuitable the use of the "ideal" formula (No. 353 in Fisher's *The Making of Index Numbers*). The purpose of this paper is to relate the question of formula to the nature of the data in a discussion of the "ideal" formula for so-called "general purpose" index numbers, especially of quantity indexes.

Professor Fisher's "ideal" formula is probably the best for both quantity and price index numbers under the following conditions:

1. When binary, or dual, comparisons are required.
2. When there is perfect comparability from a categorical or economic standpoint, between the individual series and groups to be combined; otherwise market prices (or quantities) alone cannot give the required weights.
3. When the homogeneity of the total economic situation during the period under investigation is relatively constant. Necessary additions or subtractions of subjects involve arbitrary splices difficult to incorporate in the "ideal" formula.
4. When there is practical exhaustiveness without duplication of subjects included in the index. Unequally representative series and group samples, especially when the number of subjects is limited, call for arbitrary adjustment incompatible with the automatic variability of the weighting system of this formula.
5. When for each price or quantity series, as the case may be, there is an exact corresponding and unequivocal quantity or price series; in which case only can the factor reversal test be of any significance.
6. When total value weights, probably implying the equation of exchange as a point of departure, are used.
7. When the problem is not complicated by seasonal adjustment.

[1] "A New Index of the Physical Volume of Canadian Business," this Journal, June, 1929.

Only when all these conditions are satisfied can the introduction of innumerable fixed judgments, in the form of constants applied to the factors in the "ideal" formula, be avoided and automatic weighting be obtained. Lacking these conditions the magnitude of error involved in the use from month to month of such constants (by which the individual statistician more or less arbitrarily attempts to allow for the departure of the actual situation from the perfect conditions postulated) in all probability offsets any advantages of formula No. 353. As a matter of fact, the very impossibility of obtaining these conditions, as well as the use of index numbers for more than binary comparisons, is a direct contradiction of its alleged advantages.

The specific ways in which these conditions are directly violated in the calculation of "general purpose" index numbers, with special reference to index numbers of physical volume of production or business activity, will be taken up in order.

1. Such index numbers are intended for a comparison of each month with all other months over a considerable period of time. Binary comparisons between the base period and any given month are relatively unimportant. Formula No. 353 does not satisfy the circular test, which is a logical extension of the base reversal test for more than binary comparisons; and many authorities consider the circular test as much more significant than the factor reversal test. (There are some, of course, who consider neither of them of great importance.) Chain index numbers, which are logically called for when formula No. 353 is employed, do not compensate but accumulate errors: first because of weight correlation between prices and quantities, and second as a result of random factors.[1] In short, month to month comparisons with Fisher's "ideal" formula are justified only if the structural arrangement of weights (prices in this case) is little disturbed; otherwise, the comparison is between index numbers with appreciably different weighting systems. Why, then, introduce a system of variable monthly weights, if monthly comparisons are valid only when such relative variations are slight or do not occur at all?

2. In the calculation of general purpose index numbers perfect comparability (homogeneity) is impossible to get, either from a categorical or economic standpoint. Mining, manufacturing, distribution and especially agricultural marketing, the groups generally considered for inclusion in physical volume index numbers, not only represent different stages of production but are variously related to the phenomena of the business cycle, as well as to the generally developing

[1] W. M. Persons, "The Effect of Correlation Between Weights and Relatives in the Construction of Index Numbers," *Review of Economic Statistics*, May, 1928.

economic situation. Not even for subjects in the same group is this comparison and combination simple, representing as these series do different stages of production. This compels the use of arbitrary judgments, best expressed by relatively constant factors.

3. The quantity series in a general purpose index are more or less heterogeneous; for example, the subject flour takes in numerous grades of flour, the relative importance of which may change considerably from time to time, and in the qualities of which there are wide differences at any one time. This applies to the situation as between the several groups of quantity series and to the total index over a period of time, as well as to the price series. When heterogeneous quantity series, impossible to separate into their constituent elements, are multiplied by composite prices whose weights are more or less arbitrarily determined and perhaps changed from time to time, the result is not logically simple. It no doubt takes in more than quantity changes. Results obtained under the above conditions when formula No. 353 is employed include changes in average values (total values). Index numbers as such should indicate relative changes in magnitude from time to time or from place to place in a relatively homogeneous economic variable or aggregate of variables.

4. In many series production at the stage represented is considerably less than 100 per cent. In addition, the actual series are used to represent the entire industry, or a large proportion of that industry. It becomes necessary, then, to introduce constants first to boost the series to represent 100 per cent production at the stage at which it is taken, and second to give it the "value added" by the entire industry. This treatment introduces a margin of error, as a result of the necessary use of constants from month to month, which in many cases may be much larger than the average change in price.

5. The difficulty of determining appropriate price series for weights is in a sense a crystallization of logical difficulties encountered in the use of formula No. 353. If at any given time each quantity series were perfectly homogeneous and made to represent itself only, and if there were no change in the constitution of the subjects composing the index number, the question of what prices to apply would be relatively simple. However, this is far from being the case, as already pointed out. The problem raised as to price for weights may be summarized in the following questions:

(a) Should price index numbers or price composites be used? (By a composite is here meant the weighted average of prices of different grades or classes of a particular subject, weights changing as the quantity of these grades or classes change.) Certainly to take the price of a

single grade, unless that particular grade is all important, seems hardly justified.

(b) If quantity series are used to represent the entire industry (or a good part of it) should the price series to weight these quantity series be just as inclusive? It may be argued that since the quantity series are only partially represented, the price series should be just as representative and no more. This avoids the problem by concealing its existence, for "value added by manufacture" is the resultant of price and quantity series; and the "value added" is that of the entire industry, which involves definite assumptions as to the representative character of the price as well as the quantity series. By employing the more representative price series the number of fixed assumptions involved in raising the quantity series to "value added" by the entire industry is reduced and the result is more nearly in conformity with the logic implied by the "ideal" formula, for the weighting then becomes more automatic.

(c) Is the price index obtained with the Fisher "ideal" formula a true correlative of the quantity index? This is important, for the answer must be in the negative when composite prices, as defined above, are used for weighting purposes. This inevitably follows from the discrepancy between the actual qualities and grades merged in quantity series for any one subject and the more or less arbitrary quantity weights used to obtain price composites. Furthermore, such composite prices are not of great value for other purposes. Their use for month to month comparisons over a relatively long period is valid only if the relative importance of the items which go to make them up do not change appreciably. And if changes are relatively few and far between, the price composites virtually become the ordinary aggregative index numbers. At any rate constants must be used to incorporate such relatively fixed and arbitrary judgments, and to raise (or reduce) the quantity series to a "value added" by industry basis.

The factor reversal test results from extending what logically holds for individual series to the extremely more complicated situation present in the calculation of most index numbers. This is misleading, for often in an endeavor to satisfy this test much more important matters such as the representative character of the group and the homogeneity of the economic situation (always more or less impaired by dynamics) are overlooked.

6. The automatically variable weighting system of formula No. 353 would seem to call for actual market or contract prices. The duplication in such a system of weights might be justified were it desired merely to obtain an index of T (volume of trade) in the equation of

exchange. However, index numbers of physical volume of production or business activity have not generally been calculated for this restricted use. For the more general purposes of such index numbers "value added," as theoretically more sound, is almost always chosen as the basis for weighting. Statistical inaccessibility on a monthly basis and the indirect derivation of "value added" data make necessary the use of fixed nominal prices, "value added per unit of production." This would be a sufficient practical bar (even if theoretically permissible) to the use of such a weighting system in the "ideal formula."

7. If No. 353 logically calls for seasonal adjustment of prices series as well as of quantity series, which may of course be questioned, new problems are encountered, owing to the intricacies of this formula with its four factors and the extent of the error introduced by seasonal adjustment. In some cases seasonal variation in the price weights may be greater than variations resulting from all other factors.

The problem is to avoid all these difficulties and at the same time to take account of a changing economic situation with consequent displacements in relative importance of subjects and the necessary addition or subtraction from the list of subjects in the calculation of "general purpose" index numbers. As best meeting the problem the use of a formula which is really a compromise between the aggregative with constant weights and the Fisher "ideal" formula is recommended. This is in the form of a geometric average of an aggregative with the same weights for the entire period for which the index is calculated (the first term of the formula below), and another aggregative with weights fixed for the monthly index numbers within a given period, say five years. As used in the calculation of the Canadian Babsonchart of physical volume of business activity, this formula may be written

$$\sqrt{\frac{\Sigma Q_i P_{1922\text{–}25}}{\Sigma Q_{1922\text{–}25} P_{1922\text{–}25}} \frac{\Sigma Q_i P_k}{\Sigma Q_{1922\text{–}25} P_k}},$$

where P_k is the variable weight, based on census data, which is changed every five years. This compromise formula is also used in the present Federal Reserve Board's index of industrial production and is being incorporated in a revision of the United States Babsonchart of physical volume of business activity.

It is recognized that in the above case when viewed from the standpoint of the period of five years as the unit time interval this compromise is essentially the "ideal" formula. However, during that interval there is greater flexibility and simplicity in the derivation and applica-

tion of weights. Also, interpretation of the results is made easier because uncomplicated by changing weighting systems. Accuracy is not sacrificed for the two parts of the compromise formula give the upper and lower limits, and their average is probably not far from the economic reality. Finally, keeping one system of weights unchanged throughout by affording a fixed point of reference, facilitates splicing when the other system is changed.

NOTES

THE EIGHTEENTH BIENNIAL SESSION OF THE INTERNATIONAL STATISTICAL INSTITUTE

By Walter F. Willcox

The Eighteenth Biennial Session of the International Statistical Institute was held last summer in Poland. The scientific meetings at Warsaw, August 21–24, were followed by visits to the General National Exposition at Poznan on August 25 and 26 and to the earlier Polish capital at Cracow and the adjacent salt mines of Wieliczka on August 27 and 28.

In most respects the meeting does not call for special comment to the members of the American Statistical Association, but there are two points upon which a few words of explanation may be desirable: the first about the plans for meetings at Tokio in 1930 and at Madrid in 1931, the second about an initial step looking towards changing the organization of the Institute and the scope of its work.

At the Warsaw meeting, as at the meeting in Rome four years before, the Institute received two invitations for its next meetings. At Rome a decision was made by a ballot which showed that a majority of the members present preferred to accept the invitation of the Government of Egypt. The matter was thus closed, but with a tacit understanding that the meeting four years later would be held in Poland if the Polish invitation were renewed.

At Warsaw also two invitations were received, one from Spain, the other from Japan. Unfortunately the plans in the two countries had developed so far and were so connected with other national events that either one of the prospective hosts would have been inconvenienced if the meeting in its Capital had been postponed until 1933. The difficulty was solved by deciding to hold an extraordinary meeting at Tokio in September, 1930, and a regular biennial meeting at Madrid in 1931. It is understood that a generous subvention, the details regarding which will be announced later, will provide for paying a large part of the traveling expenses of such members of the Institute as are able to attend the Tokio meeting.

A meeting of the Bureau or Executive Committee was held at Paris on December 1, about which unofficial information has been re-

ceived indicating that the agenda of the Tokio meeting will include, in addition to reports of the usual type, discussions of certain selected topics, on each of which two speakers will prepare statements, to be followed by a general debate. May I suggest that, if any American member of the Institute or of this Association, although not an Institute member, is working upon a statistical problem especially if it involves the statistics of an Oriental country and would be ready to present a paper on that subject at Tokio, he inquire of some member of the Bureau whether the subject can be placed on the program? The decision will probably lie with the Japanese local committee, but the recommendation of the Bureau or of any member of it would doubtless carry much weight.

The other matter which was considered at Warsaw and in which members of the American Statistical Association are likely to be interested was a step towards seriously examining the relation of the Institute to various other international statistical agencies, several of which have been established since the War, and the wisdom of readjusting itself to the changed situation.

A move in this direction had been made at the Rome meeting four years before, when the Bureau was asked to report to the following session whether, in view of the changes which had occurred since the foundation of the Institute in 1885 or the establishment of the Permanent Office in 1913, any changes in the statutes or in the rules governing the Permanent Office were desirable. The Bureau then invited the members of the Institute to express their opinion on this point. In order to respond more satisfactorily to the invitation, the following nine members of the Institute met in New York about four years ago (December 29, 1925): R. H. Coats, D. R. Dewey, E. D. Durand, R. P. Falkner, A. T. Hadley, W. C. Mitchell, W. M. Persons, W. F. Willcox, A. A. Young. After full discussion, they agreed upon the following statement: "We recommend that there should be no extension of the present field of statistical compilation and publication by the Permanent Office of the International Statistical Institute, pending a conference between representatives of the Institute, representatives of the Statistical Offices of the League of Nations, and representatives of other international statistical organizations, in an effort to establish a working delimitation and coördination of statistical work between these several agencies."

So far as I am informed, other members who replied to the invitation of the Bureau in this or other countries did so as individuals; about two-thirds made no reply. From the results of this correspondence with members, the Bureau rightly concluded that there was at that time no

strong current of opinion in favor of amending the statutes or by-laws or changing materially the existing practice of the Institute.

A closely related question was raised in advance of the Warsaw meeting by a letter addressed to President Delatour and signed by 35 members, asking that the subject of revising the statutes be placed on the agenda. This was done, and after much discussion both in general sessions and outside, a committee of nine members was elected to consider the question and report probably at the next regular session in Madrid in 1931. The American member of this important committee is Dr. E. D. Durand; the others are Fellner of Hungary, Flux of England, Gini of Italy, Jahn of Norway, Julin of Belgium, March of France, Rappard of Switzerland and Wagemann of Germany.

On Sunday noon, December 29, eleven members of the Institute, R. H. Coats, E. D. Durand, R. T. Ely, Irving Fisher, J. A. Hill, W. C. Mitchell, J. W. Nixon, W. M. Persons, W. M. Steuart, W. F. Willcox and E. B. Wilson had a luncheon meeting and discussed at length the situation resulting from the Warsaw session and the future of the Institute but took no formal action.

THE SIMPLEST SYMMETRICAL EXPRESSION FOR RATE OF CHANGE OF TIME SERIES DATA

By Max Sasuly, *Institute of Economics*

In the expression for rate of change, arithmetic or geometric, in a time series, some form of interpolation or graduation is necessarily involved. A very common procedure is to represent the *rate of change* by the "variate difference," assuming the time interval as unity, and the *percentage rate of change* by a form of "link-relative." This has the possible advantage of making the simplest interpolatory assumptions; but it has the disadvantage of improper centering, or, at any rate, of centering about a point of time not associated with the individual items of the time series data.

In his study of 1925 on price-level business relations,[1] Professor Fisher employs a symmetrical form for rate of change, in which this difficulty is overcome. There are other advantages in Fisher's symmetrical expression of rate of change that it would appear desirable to exhibit in detail.

Rate of change as "central difference."—Consider the time series data $y_1, y_2, \ldots, y_n$, corresponding to the equal, contiguous, time intervals centering at $t_1, t_2, \ldots, t_n$. These discrete data generally imply a continuous function $U(t)$ whose general conformation is that of the given data (t_j, y_j). The rate of change, $\frac{dU}{dt}$, at t_j is then considered given by some *graduating* function, say, a polynomial, "best" fitting (*e. g.* by the method of least squares) the data at t_j.[2] In economic statistics the rate of change is commonly taken, on the simplest interpolation assumption, as either $(y_{j+1}-y_j)/\tau$ or $(y_j-y_{j-1})/\tau$, where τ is the constant time interval. The latter may be assumed, without loss of generality, to be unity, as is usually done. Then these simple, or crude, expressions for rate of change are seen to be the precisely centered finite differences (after Gauss-Bessel).[3]

$$\left.\begin{aligned} y_{j+1}-y_j &\equiv \Delta y_{j+\frac{1}{2}}, \\ y_j-y_{j-1} &\equiv \Delta y_{j-\frac{1}{2}}. \end{aligned}\right\} \qquad (1)$$

[1] Irving Fisher, "Our Unstable Dollar and the So-Called Business Cycle," this Journal, June, 1925, p. 182, footnote 3.

[2] E. T. Whittaker and G. Robinson, *The Calculus of Observations* (1924), p. 291.

[3] S. A. Joffe, *Transactions of the Actuarial Society of America*, 18 (1917), pp. 82–84. H. Burkhardt, *Vorles: ü. Differential u. Integralrechnung* (Teubner, 1907), p. 177.

The symmetrical and properly centered expression for the rate of change at t_j $(j=2, 3 \ldots, n-1)$ as used by Fisher is

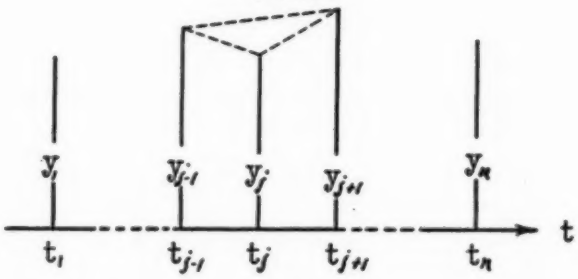
$$\delta y_j = \tfrac{1}{2}(y_{j+1} - y_{j-1}). \tag{2}$$

This is seen to be the expression, in *central difference* terminology.[1]

$$\delta y_j \equiv \tfrac{1}{2}(\Delta y_{j+\frac{1}{2}} + \Delta y_{j-\frac{1}{2}}).$$

The advantages of symmetry and proper centering of the *central difference* form δy_j become particularly apparent in the case of the *percentage* rate of change of time series, $(dU/dt)/U$. The expression commonly used is a link-relative derivation, generally, $y_j/y_{j-1} - 1$.

CHART I



But this entails the dilemma of an arbitrary choice between the equally unprecise forms $\dfrac{y_{j+1}-y_j}{y_j}$ and $\dfrac{y_j-y_{j-1}}{y_j}$. The ambiguity of centering of these two forms is avoided in another possible form $\dfrac{y_j-y_{j-1}}{\frac{1}{2}(y_j+y_{j-1})}$. The latter expression is symmetrical, but it properly centers at $t_{j-\frac{1}{2}}$, not at t_j. Evidently $\dfrac{\delta y_j}{y_j}$ is the simplest expression that is symmetrical as well as properly centered.

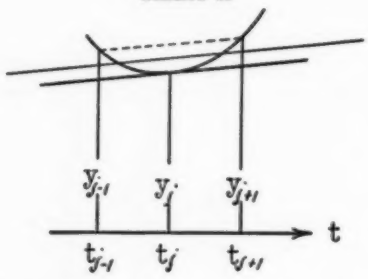
The symmetrical central difference expression for percentage rate of change may in a certain sense be considered as a balanced combination of the two unsymmetrical link-relative forms. In this aspect, it has a significant physical meaning. The expression $(y_j - y_{j-1})/y_j$ may be considered as the percentage change *up to* t_j; $(y_{j+1} - y_j)/y_j$ may be similarly considered the percentage change *away from* t_j. The average of the two is seen to be precisely the symmetrical form:

$$\frac{\delta y_j}{y_j} = \frac{\frac{1}{2}(y_{j+1} - y_{j-1})}{y_j}. \tag{3}$$

[1] W. I. Sheppard, *Proceedings of the London Mathematical Society* 31, (1899), p. 459: *Encyclopedia Britannica, 11th Ed.*, art. Differences, Finite.

Analytic-Geometrical Significance.—A concrete geometrical significance attaches to the symmetrical expression for rate of change in time series. In Chart II consider the parabola $U_2(t)$ through the three points (t_{j-1}, y_{j-1}), (t_j, y_j), (t_{j+1}, y_{j+1}) of Chart I. Designate the

CHART II



common time interval by τ. Then it can be readily shown, analytically, that the tangent at the point (t_j, y_j) is [1]

$$\left.\begin{aligned} \frac{dU}{dt}\ (t=t_j) &= \frac{y_{j+1}-y_{j-1}}{2\tau}, \\ 2\tau &= t_{j+1}-t_{j-1}. \end{aligned}\right\} \qquad (4)$$

Since in a time series τ is unity, it is seen that the symmetrical (central difference) expression for the rate of change at t_j corresponds to the *derivative,* or infinitesimal rate of change at t_j in the parabola determined by the three data points (t_{j-1}, y_{j-1}), (t_j, y_j), (t_{j+1}, y_{j+1}).

This geometric interpolation basis can evidently be extended. Thus the rate of change might be expressed in terms of the derivative

[1] Let the parabola be

$$U_2(t) = a_0 + a_1 t + a_2 t^2. \qquad [1]$$

Then the tangent slope is

$$\frac{dU_2}{dt} = a_1 + 2a_2 t. \qquad [2]$$

Let the origin be at t_j. Then the resulting coördinates for the three given points are: (τ, y_{j-1}), $(0, y_j)$, (τ, y_{j+1}). The condition that the parabola pass through these three points implies the equations:

$$\left.\begin{aligned} y_{j-1} &= a_0 - a_1\tau + a_2\tau^2, \\ y_j &= a_0 + a_1 \cdot 0 + a_2 \cdot 0, \\ y_{j+1} &= a_0 + a_1\tau + a_2\tau^2. \end{aligned}\right\} \qquad [3]$$

The solution of these equations for the parameters yields the values

$$\left.\begin{aligned} a_0 &= y_j, \\ a_1 &= \frac{1}{2\tau}(y_{j+1}-y_{j-1}), \\ a_2 &= \frac{1}{2\tau^2}(y_{j+1}-2y_j+y_{j-1}). \end{aligned}\right\} \qquad [4]$$

The tangent at the origin is, therefore,

$$\frac{dU_2}{dt}\ (t=0) = a_1 = \frac{1}{2\tau}(y_{j+1}-y_{j-1}). \qquad [5]$$

of a polynomial fitted by the method of least squares to several items centering at t_j.[1] The simplest of such polynomials is, of course, the least square straight line. If such a line is fitted to the three points (t_{j-1}, y_{j-1}), (t_j, y_j), (t_{j+1}, y_{j+1}), its slope is found to be also δy_j,[2] as in the case of the tangent at t_j to the parabola $U_2(t)$ in Chart II.

Rate of Change at the End Points.—In computing the rate of change form $\frac{1}{2}(y_{j+1}-y_{j-1})$ for all the points of the series, it is apparent that the expression cannot be computed for the end points t_1, and t_n. It is desirable to derive an expression analogous to $\frac{\delta y_j}{y_j}$ for the end points also. At any rate, it is found very convenient in the course of a computation to have as many items in the rate of change series as in the original data series.

The parabola tangent significance of δy_j, shown above, suggests a logical derivation of the rate of change at the terminal points. Consider the parabolas determined by the three end points at each end of the range. It is a manifestly reasonable assumption to express the rates of change at the points t_1, t_n by the tangents to these terminal parabolas at the corresponding points. The terminal rates of change are thus respectively:[3]

$$\left.\begin{aligned} \delta y_1 &\cong \frac{dU_2}{dt}_{(t=t_1)} = \tfrac{1}{2}[3(y_2-y_1)-1(y_3-y_2)], \\ \delta y_n &\cong \frac{dU_2}{dt}_{(t=t_n)} = \tfrac{1}{2}[3(y_n-y_{n-1})-1(y_{n-1}-y_{n-2})]. \end{aligned}\right\} \qquad (5)$$

The corresponding percentage rates of change are, of course, $\frac{\delta y_1}{y_1}, \frac{\delta y_n}{y_n}$.

[1] Whittaker and Robinson, *op. cit.*, pp. 292–297.

[2] The solution of the *normal equations* resulting from the least square criterion for fitting a straight line to n equidistant data (cf. Whittaker and Robinson, *op. cit.*, p. 292) yields the value—when the origin is taken at mid-range—

$$a_1 = \frac{\Sigma t_i y_i}{\Sigma t_i^2}, \ (i = 1, 2, \ldots, n).$$

In the present case, the t_i have the values $-\tau$, 0, $-\tau$. The corresponding y_i are y_{i-1}, y_i, y_{i+1}. Hence,

$$a_1 = \frac{\tau(y_{j+1}-y_{j-1})}{2\tau^2} = \frac{y_{j+1}-y_{j-1}}{2\tau}.$$

[3] The terminal parabolas are passed through the points whose ordinates are respectively, (y_1, y_2, y_3) and (y_{n-2}, y_{n-1}, y_n). The expression for the corresponding terminal rates of change is obtained by substituting from equation [4] into equation [2] of footnote 1, page 74.

THE RELATION BETWEEN THE ARITHMETIC AND GEOMETRIC AVERAGE OF TWO INDEX NUMBERS

By R. von Huhn

The question of time economy enters in the case of statistical computations which call for the averages of two index numbers on the geometric basis in preference to the arithmetic basis. Frequently after actual computation we find that the difference of the two averages is so slight that for all practical purposes the simple arithmetic average could have been computed instead of the more laborious geometrical one. Where many index number averages have to be computed considerable time can be saved by the following method:

The formula for the arithmetic average is:

$$M_a = \frac{x+y}{N} \tag{1}$$

and the formula for the geometric average is:

$$M_g = \sqrt[N]{x \cdot y}. \tag{2}$$

In the particular case of two index numbers $N=2$ (number of observations).

Now the difference δ between the two averages can be written, substituting $N=2$ in the equations (1) and (2),

$$\delta = \frac{x+y}{2} - \sqrt{x \cdot y}. \tag{3}$$

It is evident that the range of the difference of the two averages depends upon the difference between the two observations to be averaged.

For example let us assume two index numbers $x=200$ and $y=250$

$$M_a = \frac{200+250}{2} = \frac{450}{2} = 225.0$$

$$M_g = \sqrt{200 \cdot 250} = \sqrt{50000} = 223.6$$

Now $$\delta = M_a - M_g = 225.0 - 223.6 = 1.4.$$

The arithmetic difference between the two index numbers $x=200$ and $y=250$ equals $D=50$ and for this difference between the index numbers the difference between the arithmetic and geometric averages is 1.4.

But if $x=100$ and $y=350$

$$M_a=\frac{100+350}{2}=\frac{450}{2}=225.0$$

$$M_g=\sqrt{100\cdot 350}=\sqrt{35000}=187.1$$

$$\delta=225-187.1=37.9.$$

In both examples the arithmetic average remained the same, whereas the geometric average varied, which shows that the difference D between two index numbers determines δ, being the difference between the arithmetic and geometric average. How large may D become so that δ will not exceed a certain value, or to put it the other way: What value must δ have to begin with which will make it permissible to use the arithmetic computation rather than the geometric one, and without committing an error which will affect the resulting average beyond a certain per cent of accuracy?

Now a term can be found which will enable us to compute how large the difference between two index numbers, x and y, may become if the difference δ is to stay within an assumed limit.

If the factor D, which equals the difference between the two index numbers x and y, expressed in terms of y, is introduced in equation (3) and if we consider x to be the smaller one of the two index numbers, we obtain:

$$D=y-x$$
$$y=D+x.$$

Substituting for y, $D+x$ in equation (3) we obtain:

$$\delta=\frac{x+D+x}{2}-\sqrt{x\cdot(D+x)}.$$

Simplifying:

$$\delta=\frac{2x+D}{2}-\sqrt{x^2+D\cdot x}$$

$$\delta=x+\frac{D}{2}-\sqrt{x^2+D\cdot x}. \qquad (4)$$

By solving for D we obtain from equation (4):

$$\left(x+\frac{D}{2}\right)-\delta=\sqrt{x^2+D\cdot x}$$

$$x+\frac{D}{2}-\delta=\sqrt{x^2+D\cdot x}.$$

Squaring both sides of the equation:

$$(x-\delta)^2+(x-\delta)\cdot D+\frac{D^2}{4}=x^2+D\cdot x$$

$$\frac{D^2}{4}-D\cdot\delta+(\delta^2-2x\cdot\delta)=0$$

$$D=\frac{4\delta\pm\sqrt{16\delta^2-16(x^2-2x\cdot\delta)}}{2}$$

$$D=\frac{4\delta\pm\sqrt{32x\cdot\delta}}{2}$$

$$D=\frac{4\delta\pm4\sqrt{2x\cdot\delta}}{2}$$

$$D=2\delta\pm2\sqrt{2x\cdot\delta}\,. \qquad (5)^1$$

where x = the smaller index number of the two
D = difference between two index numbers
δ = difference between M_a and M_g.

In the quadratic equation (5) the minus sign has no significance for computing Table I.

TABLE I

$D=2\delta+2\sqrt{2x\cdot\delta}$
$\delta=.005$

X	Y	D	X	Y	D
10	10.64244	.64244	210	212.90826	2.90826
20	20.90442	.90442	220	222.97646	2.97646
30	31.10542	1.10542	230	233.04314	3.04314
40	41.27490	1.27490	240	243.10838	3.10838
50	51.42420	1.42420	250	253.17226	3.17226
60	61.55918	1.55918	260	263.23490	3.23490
70	71.68332	1.68332	270	273.29632	3.29632
80	81.79884	1.79884	280	283.35664	3.35664
90	91.90736	1.90736	290	293.41586	3.41586
100	102.01000	2.01000	300	303.47410	3.47410
110	112.10760	2.10760	310	313.53136	3.53136
120	122.20088	2.20088	320	323.58770	3.58770
130	132.29034	2.29034	330	333.64318	3.64318
140	142.37642	2.37642	340	343.69780	3.69780
150	152.45948	2.45948	350	353.75164	3.75164
160	162.53982	2.53982	360	363.80472	3.80472
170	172.61768	2.61768	370	373.85716	3.85716
180	182.69328	2.69328	380	383.90870	3.90870
190	192.76680	2.76680	390	393.95460	3.95460
200	202.83842	2.83842	400	404.01000	4.01000

[1] For those who are interested in the behavior of the equation $D=2\delta+2\sqrt{2x\cdot\delta}$, it may be stated that if we differentiate D with respect to x, holding δ constant the differential quotient $\frac{dD}{dx}=\frac{2\delta}{\sqrt{2x\cdot\delta}}$. Further investigation shows that $D-2\delta$ (or what is the same, $2\sqrt{2x\cdot\delta}$) multiplied by the above differential quotient is constant.

Let us assume now that for reasons of accuracy the difference δ between the two averages shall not exceed .005 or $\frac{1}{2}$ of 1 per cent, and furthermore that the method is going to be used for computing averages of two index numbers, the latter ranging from 10 to 300, it is then only necessary to substitute in equation (5) different values for x, $\delta = .005$ being constant, to obtain Table I.

The table can be used in the following manner: If, for example, the smaller index number is $x = 50$ and the difference between M_a and M_g shall not exceed $\delta = .005$, then the larger index number y cannot exceed $50 + 1.4242$ or 51.42420. In other words, the arithmetic average M_a of two index numbers 50 and 51 would be just as exact within the prescribed limit ($\delta = .005$) as if we had taken the geometric mean which is certainly a more involved operation.

Now $\frac{50+51}{2} = 50.50000$ and $\sqrt{50 \cdot 51} = 50.49752$ and $\delta = .00248$, representing the actual difference between the averages of the index number $x = 50$ and $y = 51$, which is well below the assumed limit. Therefore, in this case arithmetic operation can be used safely.

The method can be applied to any desirable limit of δ. In the case of actual work the computor can determine from Table I whether or not arithmetic operation can be used instead of geometric, thereby eliminating the time of multiplying two index numbers and extracting the square root.

CONCENTRATION OF STATISTICAL SERVICES IN ITALY

By G. Zabiello

As explained in the paper on "The New Organization of the Statistical Services in Italy," published in this Journal, September, 1927, the whole structure of the statistical service in Italy was rebuilt by the law of July 9, 1926, with the creation of an autonomous "Central Institute of Statistics," instead of the former General Direction of Statistics which was under the Ministry of National Economy. A few years' practice having shown that the new ordinance still contained some gaps, a further law was issued on May 27, 1929, the chief aim of which was to bring about change towards a greater centralization and a closer coördination of the statistical work in Italy.

With this aim new tasks were introduced in the program of the Institute. One such task is that the Institute give directions and instructions for statistical research to the corporate bodies, as it has heretofore dealt with the ministerial and other governmental offices, and that it prevail upon these bodies to collect the statistical data needed for the researches undertaken by the Institute itself. It has further the duty of giving advice on every scheme and design of statistical work contemplated by other governmental offices or corporate bodies, whose plan, regularly drawn up for a whole year, ought to be previously submitted for the approval of the Institute.

Besides, the Institute is instructed to make proposals for eventual changes in the statistical services of the various offices and corporations and is to act as a clearing house for all the statistical information asked for by international and foreign institutions, which information is to be furnished by the respective Italian offices only through the channel of the Institute. A further duty is to suggest to the Chief of the Government the officials to be commissioned as representatives of Italy at the International Committees, congresses and conferences summoned for discussion of statistical topics.

As above mentioned, the chief change introduced by the new law tends towards a greater concentration of all statistical work in the Central Institute of Statistics. With such purpose the new law settles that all the statistical services which are now performed by the various central departments of the public administration shall be gradually transferred to the direct dependency of the Central Institute of Statistics, whereas in the meantime, till such concentration is achieved, the respective services ought to be committed to the charge of special officers exclusively entrusted with the work.

This close concentration is expected to assure a perfect unity of program, method and control in the effectuation of statistical investigations as well as in the final elaboration of their results, and to allow an easier achievement of the further improvement of the statistical work in Italy.

As the three years immediately following the creation of the Institute constituted chiefly a period of reconstructive work, under the new law the Institute is now called upon mainly to bring about the gradual performance of the planned concentration.

Finally a few words remain to be said about the Presidency of the Institute, which according to the law is to be entrusted to the President of the Superior Council of Statistics. Professor Corrado Gini, who has filled both these functions since the constitution of the Institute and achieved the reconstruction of the Italian statistical service, is now confirmed for a further period of four years in his appointment to both chairs. At the same time the composition of the Superior Council of Statistics is slightly changed by a diminution of the number of public officials and by an increase of the number of representatives of statistical and economic knowledge and scientific authority.

THE IMPORTANCE OF AN INDEX OF SPECIFIC RELATIVE GROWTH OF INDUSTRIES

For several reasons it is desirable to obtain an index of the rate of growth of the different industries and to compare these rates with the rate of growth of industr as a whole. The first reason is that persons engaged in the producing of and trading in an article are aware that they are competing for the dollars of their customers with those earning their living in other lines of business. This is true for those producing or selling consumers' goods, as well as for those who provide other industries with their requisites.

The business man needs an index representing the outcome of this battle, a continuous registration of the effect of this type of competition, which would be comparable to the posting of the score of a football match. In case his sales diminish, he wants to know to what extent this decline is of temporary character, and one of the most necessary elements in this calculation is the knowledge of the situation in other trades. In case there is a definite trend of the flow of money in other directions, he must know it, and at present he does not obtain the information required at a sufficiently early date. In some cases changes in the direction of the flow of money are obvious; the piano dealers, for instance, felt and recognized the competition of the radio very soon after its appearance in the field of business. But in many other cases circumstances are more complex, and even if it is possible to discern the channels of trade which money follows on its new course, it is not possible to estimate the importance of this change even with a moderate degree of accuracy.

A gradual decline in the rate of growth of sales is not always immediately observed, and when observed it continues some time before the conclusion is drawn that there is a definite change in the trend of demand. The change may, at first, be taken for a temporary one, or the conclusion may be drawn that the individual business is losing ground in the industry.

The second reason why such additional information is required is its necessity from the point of view of the study of the business cycle. Several explanations of the business cycle stress the action of the principle of substitution in our continuously changing society. As Marshall showed us, this action presents itself mainly in three forms: First, instead of one commodity people buy another one; second, within one trade one enterprise supplants another; and third, within one enterprise a certain quantity of one agent of production supersedes a certain quantity of another agent of production.

All of these are important in the study of the business cycle, but at present we are only concerned with the observation of the first. In order to know whether there is any danger of collapse of business, we must follow the battle of the different industries and trades for their share in the flow of money, and in case violent substitutions are taking place such an observation will be a valuable element in the process of economic diagnosis, and therefore an indispensable element in economic prognosis.

It is obvious that the information given by such observations is limited and that it does not compete with the current indices of a different kind, which it

...es by no means superfluous. It does not even suffice for the study of the soundness of the branches of business considered, for, in order to gauge the soundness of business, we ought to have an additional index of the movement of the cost of production, which will not easily be obtained.

But it would give us important data, for, in general, an increasing rate of growth is a sign of soundness, and a declining rate of growth is an indication of a danger which could be an incentive for a deeper study of the situation in the branches of business which are suffering from this relative or absolute decline. Such a study is nowadays only made when it is too late, that is when the decline of the branch of industry considered has gone so far that it asks for relief.

In particular, it would be interesting to compare the rate of growth of an industry with the general rate of progress. This would be easy if we had promptly available information about the growth of industry as a whole. We could then express the sales of every branch of business as a relative to the total sales of all commodities.

At present, however, we only have this valuable information for a limited number of industrial groups. It is a splendid beginning and we may be satisfied in having it; besides there is a reasonable hope that the work will be extended in the course of time. As the groups chosen are very important, it would be feasible to express the sales of one group as a relative of the total sales of all the groups we have. But it seems to me that it would be better to compare the specific sales with an index of the total money volume of business. The most suitable index for this purpose would be the "outside" bank debits. The index should be corrected for normal seasonal variations, but, of course, not for secular trend.

These, however, are technical matters, and the object of this note is not so much to propose a definite index as to stress the necessity of obtaining this additional information on the situation in business.

WILLEM L. VALK

COMMENT ON "THE VARIATE DIFFERENCE METHOD OF SEASONAL VARIATION"

The study of Richard A. Robb with the above title [1] is interesting because it is the first to be published in this JOURNAL which (1) explicitly formulates a hypothesis regarding the functional relationship of four types of fluctuations present in economic time series, and (2) deduces mathematically a method of isolating the seasonal variation.

However, the proposed method appears unnecessarily "heavy" on account of the use of Fourier's series. The seasonal variation can be obtained direct from $\Delta^3 S$ by simple numerical integration.

The third column is ΔS, obtained by cumulating $\Delta^3 S$, f is the unknown constant of integration. The fourth column is the seasonal variation S. It contains two unknown constants of integration, f and g; f is determined by the condi-

[1] This JOURNAL, September, 1929, p. 250.

INTEGRATION OF S

Month	$\Delta^2 S$	ΔS	S	S
January	4.8			
February	10.8	$4.8+f$		
March	23.4	$15.6+f$	$4.8+f+g$	−83.8
April	66.0	$39.0+f$	$20.4+2f+g$	−89.1
May	−12.1	$105.0+f$	$59.4+3f+g$	−70.9
June	−52.4	$92.9+f$	$164.4+4f+g$	+13.2
July	−33.2	$40.5+f$	$257.3+5f+g$	85.1
August	−15.6	$7.3+f$	$297.8+6f+g$	104.9
September	−11.6	$-88.3+f$	$305.1+7f+g$	91.4
October	−0.5	$-19.9+f$	$296.8+8f+g$	62.2
November	+14.3	$-20.4+f$	$276.9+9f+g$	21.5
December	+6.0	$-6.1+f$	$256.5+10f+g$	−19.8
January		$-0.1+f$	$250.4+11f+g$	−46.7
February			$250.3+12f+g$	−67.7
			2440.1	

$12f=-250.3$; $f=-20.85$
$12g=-2440.1-78f$; $g=-67.82$

tion that $\Sigma\Delta S=0$, and is found to be -20.85; g is determined by the condition $\Sigma S=0$, or $2440.1+78f+12g=0$, or $g=-67.82$.

The fifth column shows S which checks satisfactorily with the "Total" column of Robb.[1]

VICTOR S. VON SZELISKI

A REPLY TO DR. LOTKA'S REVIEW OF "THE BALANCE OF BIRTHS AND DEATHS"

Alfred J. Lotka, in his review of my book *The Balance of Births and Deaths*, Volume I, Western and Northern Europe, after having summarized the main results, says:[2]

> These are some of the outstanding results of the very interesting study made by Kuczynski. The obvious conclusion, at first sight, seems to be that the population of Europe is headed for a decline in numbers, despite the present excess of birth-rate over death-rate, an excess not due to inherent fertility, but to a peculiarity of the prevailing age distribution. The argument is identical with that of Dublin and Lotka's study, "The True Rate of Natural Increase,"[3] which is mentioned by Kuczynski in two incidental footnotes, in Chapters II and III without, however, giving the reader any indication that this prior study fully brings out very prominently the four principles set forth in italics as the very backbone of Kuczynski's Chapter IV, namely (1) *In the present population . . . the proportion of women in childbearing ages is particularly large and old persons particularly small.* (2) *The decisive factor in shaping the present population . . . was the trend of births.* (3) *The age composition . . . tends to lower the number of deaths.* (4) *The age composition tends to swell the number of births.* No reference whatever is made, throughout this chapter, to prior publication of these four principles, and the reader not acquainted with the literature will certainly be left with the impression that these principles were originated by the author. As they are fundamental to the whole thesis, the omission seems regrettable.

[1] This JOURNAL, September, 1929, p. 254 (bottom).
[2] This JOURNAL, September, 1929, p. 332.
[3] This JOURNAL, September, 1925, p. 305.

The four italicized sentences, to which Lotka refers, read as follows:

> *In the present population of Western and Northern Europe the proportion of women in child-bearing age is particularly large and the proportion of young children and old persons particularly small.* (p. 55.)
>
> *The decisive factor in shaping the age composition of the present population of Western and Northern Europe was the trend of births.* (p. 56.)
>
> *The age composition of the population of Western and Northern Europe tends to lower the number of deaths.* (p. 57.)
>
> *The age composition of the population of Western and Northern Europe tends to swell the number of births.* (p. 60.)

These sentences merely served to answer for the reader not familiar with the intricacies of vital statistics the question: "How is it to be explained that with a birth-rate of 19.2 and a death-rate of 13.0 the population of Western and Northern Europe does not hold its own?" (p. 55.) Similar arguments have been used, as I have shown in my book *Der Zug nach der Stadt*, Berlin 1897, by practically all authors who in the course of the eighteenth and nineteenth centuries tried to explain how with an excess of births over deaths the native urban population in Europe did not hold its own. Similar arguments have likewise been used by Dublin and Lotka in order to explain how with an excess of births over deaths of 11 per 1,000, the white females in the United States had in 1920 a genuine increase of 5.5 only per 1,000. A reader of Dublin and Lotka's study who thought that "these principles were originated by the authors" must indeed have been very little "acquainted with the literature."

As to the methods by which I reached my results, they were originated in part by Richard Boeckh in 1886, in part by myself in 1907.[1] The fact that such eminent statisticians as Dublin and Lotka applied our methods in 1925 was most pleasing to me, and I never considered as regrettable their omission to quote us as the originators of those methods. Why indeed should I regret that?

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REJOINDER

A perusal of Dr. Kuczynski's book of 284 pages, *Der Zug nach der Stadt*, has netted essentially the following brief passage as pertinent to the points raised by him in his *Reply:* After mentioning that in certain localities an exceptional situation is encountered, in which higher age groups contain a larger proportion of the population than lower age groups of the same class interval, Kuczynski remarks: "Whether and to what extent immigration and emigration here entered into play (eine Rolle spielten), cannot be ascertained in the present state of statistics of migration. Certainly the essential cause (of the abnormal age distribution) was the very large number of births in the second half of the seventies (*i.e.*, 1875–1880), which, in spite of the increase in population, was not attained in the eighties." This seems hardly enough to cause the writer to change the views expressed in the review. It must be left to the reader to compare the

[1] See *The Balance of Births and Deaths*, Vol. I, pp. 20–24, 44.

incidental remark quoted above from *Der Zug nach der Stadt*, with the detailed numerical study and graphic illustrations exhibited in the "True Rate of Natural Increase," and to form his opinion whether adequate mention of this publication has been made in Kuczynski's book.

That one part of the study on the True Rate is clearly anticipated in the literature is admitted, namely, the computation of the net reproductivity (ratio of total births in successive generations). It should be noted, however, that this part of the article on the True Rate takes up about one page out of a total of 35. It forms, in fact, so relatively unimportant a part of the paper that it is not even mentioned at all in the seven numbered paragraphs of the Summary. Only one point may here be selected for special mention. There is no hint in Kuczynski's work of any method for computing the true annual rate of natural increase, nor the corresponding birth-rate and death-rate. The determination of these, as its title implies, was the fundamental purpose of the paper.

But perhaps, after all, the main point on which the reviewer differs from Dr. Kuczynski is in the matter of regrets. I sincerely regret that the prior publication of Boeckh's method of computing the net reproductivity was not mentioned in the "True Rate of Natural Increase." The omission was wholly unintentional, the prior work not having come to my notice.

ALFRED J. LOTKA

BANK MERGERS

The American Statistical Association held a dinner meeting at the Aldine Club, 200 Fifth Avenue, New York City, on December 5, 1929. There were 154 persons in attendance. The general topic for discussion was "Bank Mergers—What Is Their Portent?" Edwin B. Wilson, President of the American Statistical Association, presided.

The first speaker of the evening was Dr. Willard L. Thorp, Professor of Economics at Amherst College. His subject was, "The Trend Toward Consolidation." He pointed out that while in the early years of the twentieth century the tendency to consolidation was confined mainly to the fields of manufacturing and transportation, at the present time, the movement is extending to all fields of industrial activity. For example, mergers of companies engaged in the production of electric light and power increased in number from a score in 1920, to 1,029 in 1926. Since the last mentioned date, the number of mergers had declined, primarily because of the exhaustion of material for merging, for there cannot well be mergers unless there are companies to be merged. Experience shows that the merger movement is strongest in years when it is easiest to float stocks. The fact that 1929 has been a banner year for industrial mergers, is explainable on this ground. During recent months, mergers have been notably active in the field of the manufacture of automotive parts, and textile manufactures.

Middle-size concerns are frequently merged in order to secure economies in the sale of their products. Most mergers are not, however, undertaken on the

initiative of the companies merging but are due to the activities of promoters. Dr. Thorp pointed out that, at present, about three-fifths of all banks operate under State charters, and about three-tenths of all banks are National. The number of banks has been declining since 1921, having dropped from 31,000 in that year to 26,000 at the present time. This diminution in numbers is primarily ascribable to the large number of bank failures which have occurred. Although the number of banks has been diminishing, the total resources of banks have increased, during the period just mentioned, by 50 per cent. Of the member banks in the Federal Reserve system, about 125 per year were taken into consolidations up to 1925. By 1928, this number had increased to 204.

Until recently, the merging banks have been rather typical representatives of all banks, but, during recent months, most mergers have been caused by large banks absorbing smaller ones.

Two types of consolidation should be distinguished: The first, branch banking, a type confined to a single city or county; the second, chain banking, a type which may extend over an indefinite area. The latter type is at present a very common form of merger. In this form, all the banks are owned by a holding company. This holding company may, or may not, be dominated by a single large bank. Frequently, it is controlled by a single individual. At present, holding companies control about 7 per cent of all the banks and about 20 per cent of all the resources of banks.

One of the reasons urged for mergers is the hope that they will prevent failures. That they actually do so, has not yet been demonstrated. In many cases, however, the banks merging do not increase the volume of their outstanding securities. The public nowadays does not seem to be opposed to mergers, but the independent banker objects strongly to branch banking. The truth is, however, that chain banking is likely to be worse than branch banking. Thus far, the Federal Government has, in general, been hostile to bank consolidation and branch banking. When, however, we see how ineffectual has been the objection of the Government to industrial consolidations, we are led to wonder whether or not its opposition will do much to hinder bank mergers.

The second speaker was Professor Walter E. Spahr, of New York University, who discussed "Banking Concentration and the Depositor." He began his remarks by pointing out that about the only guide that we have as to the effect of banking concentration on the depositor is the experience of other countries. This experience is, however, not conclusive, for the United States differs so materially from other nations that what succeeds there may not succeed here. Furthermore, the effect of bank consolidation may be very different in a large city from what it is in a small community. The chief interest of the city depositor is in banking convenience. He has little local pride in the bank with which he does business, hence he does not object particularly to bank mergers.

In making loans, the larger banks have, in the past, tended to depend more upon the collateral offered than upon the character of the borrower. This has not been true, to the same extent, in the case of the smaller banks. The present tendency is for the larger banks to approach the position of the smaller banks in this regard.

The advocates of bank consolidation contend that bank mergers make it possible to grant loans large enough to satisfy the needs of giant corporations. They also hold that large banks are able to give more expert assistance to investors than can smaller banks. The answer to those who fear that the depositor will not be treated with the same consideration at the large as at the small bank, is that, if they are not treated with courtesy, they will go to some other bank, since transportation in the city is so easy. Some writers on the subject have expressed fear that, where branch banking exists, one central bank failure may wreck a whole series of banks. The main denial of this is that chain banks, or branch banks, are not likely to grant undue credit to any one individual.

The speaker felt the danger that giant banks will oppress the depositors to be slight, for he pointed out that consolidation has not as yet progressed far enough to eliminate keen competition. Bank mergers, however, need to be subjected to careful supervision. Such supervision is harder to apply to chain banks than to branch banks.

The third speaker of the evening was Mr. Frank C. Thomas, President of the Bankshares National Corporation. He discussed "The Probable Effect of Bank Mergers on Prices of Bank Stocks." He showed that, in many cases, the prices of bank stocks do rise immediately after a merger, but often decline soon thereafter. Mr. Thomas cited several specific examples of the effect of mergers upon bank stocks. In the first case, the merging of a group of successful banks did not raise the ratio of the total stock value to total earnings. In the second case, however, the merger succeeded in increasing earnings materially without inflating the par value of the stock, with the result that the total market value of the stock was multiplied by 2½. In the third instance, when two banks, the services of which were complementary, united, the market value of the stock of each bank was increased. In the fourth case, the announcement that a merger would not take place caused the price of the stocks of two New York banks to rise sharply.

Mr. Thomas held that mergers tend, in general, to increase the prices of the stocks of the banks whenever the merger results in economy. In some cases, it is possible to dispense with a large number of officers and to eliminate the upkeep of some buildings. In such instances, the expense account may be prevented from eating up the profits and the value of the stocks will necessarily rise. The biggest obstacle to bank mergers is that they cause bank presidents to lose lucrative positions.

While mergers in banking have been going along at a rather rapid rate, their pace has been slower than that in industrial lines. They seem to be a necessity if great industrial corporations are to have an adequate source of banking credit. Unfortunately, in many cases customers are not as well treated after the merger takes place as they were before.

It is often true that there seems to be little relationship between the price of the stock of a bank in New York City and the earnings of the bank. One reason for this is that New York City is a great center for bank stock speculation. Another is that many people feel that to own a share of bank stock is a mark of respectability.

The discussion was opened by Professor H. Parker Willis, of Columbia Uni-

versity. He expressed the view that it is probably unwise to allow mergers to be formed which are merely stock-jobbing propositions, for such mergers often benefit the promotors only. On the other hand, mergers formed for logical banking reasons are, in general, desirable. We need not fear mergers but only their bad phases. It is easier to regulate the banking business when it is in large, than when it is in small units.

The reason leading to the formation of a merger is generally one of the following:

1. The danger that a bank is going to fail. The merger may save it and thus protect the depositors.
2. A bank may be growing very slowly, so that it would be a long time before it would attain any considerable size. A merger may enable it to obtain at once enough capital to make it a profitable enterprise.
3. The desire for economy. Unfortunately, it does not appear that, in most cases, mergers actually do promote economy to any considerable extent.

One of the principal reasons for establishing bank chains is to enable the actual owners of the chain to rid themselves of the double liability imposed upon bank stockholders by law. Chain banking is usually much more dangerous to the public than is branch banking. The latter is, in most cases, both wholesome and legitimate. Another reason leading to the merging of banks is that, in many cases, the men in control are incompetent. The merger offers a way to get rid of the president who is hampering the development of the business.

There can be no question but that we need more complete laws for governing mergers. Mergers should not be permitted except when they are organized in public interest. No one should be allowed to go into the banking business who is not qualified for that work.

The last speaker of the evening was Mr. Pierre R. Bretey, of the Brookmire Economic Service. He pointed out that, recently, banks have done much stock speculating as well as banking. Many banks aim to sell their own stocks to their own customers. Frequently, the relation of the value of the stock to earnings becomes absurd. At the peak of prices in 1929, the price of New York bank stocks averaged 38 times earnings. Recently, they have dropped until their prices average only 19 times earnings. The reason that bank stocks have sold at such extremely high figures is that the New York banks have been growing at a very rapid rate and hence a great increase in earnings is anticipated by the majority of the investors. The probabilities are that the earnings of the larger banks will continue to increase rather rapidly for some time to come; hence it is not improbable that their stocks will also ascend still higher. The fact that bank mergers have enabled banks to engage in security speculation has probably contributed to the sharpness of the recent decline of the stock market.

The meeting adjourned.

WILLFORD I. KING, *Secretary*

PROGRESS OF WORK IN THE CENSUS BUREAU

Preparation for the Enumeration

Preparations for the Fifteenth Decennial Census to be taken next April are now in full swing. All but a few of the 574 supervisors, who are to be the divisional field superintendents of census-taking, have been appointed; and applications for appointments as enumerators are coming in at the rate of a thousand or two a day. Each applicant is required to fill out a test schedule on which he must enter the census facts as given in a narrative descriptive of a number of hypothetical families whom the enumerator is supposed to visit. In order to do that he must read and understand the printed instructions with which he is supplied. The candidate for the position of supervisor must take the same test. He also must know his instructions.

About 60 clerks are engaged in reading, correcting, and grading these test schedules. Ultimately the corrected schedules will be returned to the applicant if appointed, so that he may profit by his mistakes. From 15 to 20 per cent of applicants fail to pass the test. The supervisor will be supplied with a list of those applicants from his district who have successfully passed the test, and from this list he must make his selection of enumerators.

Arrangements have been made to have the Director of the Census visit some of the principal cities for the purpose of meeting, consulting with, and instructing the supervisors. The supervisors from the surrounding country will be assembled at these meeting places.

The first meeting of this kind was held in Washington on January 10 and 11, at which about 80 supervisors were present, coming from Maryland, Delaware, Virginia, Pennsylvania, southern New Jersey, North Carolina, and West Virginia.

The Population Schedule

Although some information regarding the population schedule was contained in the December issue of this Journal, the final form had not at that time been decided upon, and therefore it is believed that readers will be interested in a complete statement at this time.

The schedule carries the following questions:

1. Relationship to head of family, with special provision for distinguishing the home-maker in each family.
2. Whether home is owned or rented.
3. *Value of home, if owned, or monthly rental, if rented.
4. *Whether the family has a radio set.
5. Does this family live on a farm?
6. Sex.
7. Color or race.
8. Age at last birthday.
9. Marital condition.
10. *Age at first marriage. (For married persons only.)
11. Attended school or college any time since September 1, 1929?

* New Question.

12. Whether able to read and write?
13. Place of birth of person. (State or country.)
14. Place of birth of person's father. (State or country.)
15. Place of birth of person's mother. (State or country.)
16. Mother tongue of each foreign-born person.
17. Year of immigration to the United States. (For foreign born only.)
18. Whether naturalized. (For foreign born only.)
19. Whether able to speak English.
20. Occupation of each gainful worker.
21. Industry in which employed.
22. Whether employer, employee, or working on own account.
23. Whether actually at work. (For each person usually employed but returned as not at work, additional information will be secured on a special unemployment schedule.)
24. *Whether a veteran of the United States military or naval forces; and for each veteran, in what war or expedition he served.

Four questions included in the population census of 1920 have been omitted, namely: Whether owned home is mortgaged, year of naturalization for naturalized citizens, mother tongue of foreign-born father, mother tongue of foreign-born mother. Furthermore the two questions "whether able to read" and "whether able to write" have been consolidated into one question "whether able to read and write."

Of the new questions the most important perhaps is that calling for the value of the home, if owned, or the monthly rental, if rented. This will make possible a classification of families according to economic status, or perhaps one might say according to buying power. Such a classification is urgently desired by individuals and firms using the census figures as a basis for organizing their selling and advertising campaigns and will serve many other purposes. The replies to these questions will be used only as a basis for classification of the families into broad groups. Of course the value of any individual home will not be revealed to the public, or to tax assessors, or anybody else outside the Census Bureau. It will be used only for statistical compilations.

The question "age at marriage" was not included in the census of 1920, but in 1900 and again in 1910 the equivalent question "number of years married" was on the schedule, although the data were never tabulated. This question will serve two purposes. In the first place it will give definite information as to the relative age at marriage of persons in different racial and economic groups. In the second place it will make possible a tabulation of important data on the size of families, such tabulation to be based on the number of children reported in the families of women who have been married a stated number of years, say 10 or 15.

The inquiry on radio sets will give a direct answer to the question as to how large the potential radio audience is.

In the classification of gainful workers according to occupation and industry

*New question.

it is proposed to put much greater stress than heretofore on the returns for industry, and to instruct the enumerators to pay special attention to this section of the schedule. More extensive use will be made of the industrial classification in the final reports, including, among other things, the distribution of all clerical workers among the various industries and industry groups.

Women doing housework in their own homes (or supervising such work done by servants) and carrying the other responsibilities of the home will be designated as home-makers. This designation will be entered in the family relationship column of the schedule, rather than in the occupation column, in order that those women who follow a profession or other gainful occupation, in addition to being home-makers, may be properly classified in respect to both lines of activity.

THE UNEMPLOYMENT SCHEDULE

As stated in the September issue of this JOURNAL, the census of unemployment will make use of a supplementary schedule. On this schedule will be entered the name of every gainful worker reported on the population schedule as idle on the last regular working day preceding the enumerator's visit. The questions on the unemployment schedule are as follows:

1. Does this person usually work at a gainful occupation?
2. Does this person have a job of any kind?

Question 2 will divide those scheduled into two groups:

If this person has a job—

3. How many weeks since he has worked on that job?
4. Why was he not at work yesterday (or the last preceding regular working day)?
5. Does he lose a day's pay by not being at work?
6. How many days did he work last week?
7. How many days in a full time week?

If this person has no job of any kind—

8. Is he able to work?
9. Is he looking for a job?
10. For how many weeks has he been without a job?
11. Reason for being out of a job (or for losing his last job)?

In addition to the information recorded in answer to these questions, the schedule will have columns for the transcription from the population schedule of data relative to sex, age, marital condition, color, nativity, occupation; whether an employer, working on own account, or an employee; and the number of persons in the family employed, dependent, and unemployed.

It may be admitted that these questions will not tell us everything we would like to know about the unemployed. But we have to consider what is practicable as well as what is desirable. The questions were determined after lengthy and painstaking study by officials of the Department of Commerce and

of the Census Bureau, assisted by an advisory council of experts and by many other interested persons and organizations.

Contrary to a somewhat prevalent impression, censuses of unemployment are not new. Massachusetts took such a census in 1885 and published the results in 1887, finding that about a third of her 800,000 workers "were unemployed at their principal occupation about a third of the working time." The Federal Government has included inquiries regarding unemployment in four decennial censuses, in 1880, 1890, 1900, and 1910. The results for 1880 and for 1910 have never been published. In 1880 this was due to lack of funds, joined to doubts as to the validity of the results. The Census Bureau had not fully installed machine tabulation in 1880. In 1910 there were delays due to the exhaustion of census appropriations. Popular interest in the subject was not great, perhaps by reason of the prevalent prosperity during the census period. The published results in 1890 and 1900, like the returns in 1880, were based on the question, "Months unemployed during the census year?" This is a question difficult of exact answer in any case, and doubly so when the answers, as is frequently true in census taking, are given by persons other than the gainfully employed individual.

As stated by Professor Mayo-Smith in 1899: "We might inquire of each individual how many days he had lost during the year and the reasons for the loss of employment. This would be the ideal way, and if we had full and truthful answers it would give us a complete picture of the condition of employment. This method is practically impossible of realization, owing to the ignorance and untruthfulness of men. We might ascertain on a given census day how many men were unemployed. This is easier but gives less information."

The census of unemployment in 1910 adopted this second alternative in part. For while the inquiry as to months unemployed during the year was repeated, there was in addition a question of the type suggested by Mayo-Smith a decade earlier. It asked whether the person was unemployed on the census day, April 15, 1910, and was so phrased as to admit of a "Yes" or "No" answer. Such inquiries promise a more definite and dependable result. This type of question was the basis of the census of unemployment taken by the Union of South Africa in 1921.

The census of 1930 undertakes to distinguish only those unemployed at the time of the census and to obtain as much information as seems practicable regarding the cause and extent of their unemployment.

J. A. H.

MISCELLANEOUS NOTES

The Chicago Chapter.—At the first fall meeting on October 23, before an audience of 39 members, Dr. A. J. Snow, of Sears Roebuck and Company, spoke on "Methods of Determining Nation-Wide Trends in the Price and Quality of Consumer's Merchandise."

Dr. Snow did not go into the detailed statistical methods employed in the sales

research work which he is conducting, but devoted his time outlining and discussing in a general way, the factors which he considered particularly necessary to investigate.

He dealt with the type of research activity which yields results in a short time rather than with that type of problem in which it takes years to obtain results. Examples of a problem about which definite recommendations can be made in the course of a few weeks are (a) what sizes and colors of paints should be selected in order to save inventory and warehouse expense; (b) how many colors is it desirable to carry in a paint that costs $3.50 a gallon as compared to one which costs $1.75. Recommendations are always based on quantitative measurements of some sort and rather than merely furnishing general information about the problem, a specific suggestion is made as to the action to be taken.

Dr. Snow discussed various factors which should be considered in sales research, giving especial consideration to the following:

1. In sales research the first step is to study the market and compare the trend of the national market in dollars and units with the trend of sales in the department under consideration. Is the department keeping up with the total market?
2. A survey should also be conducted to determine the prices at which similar goods are selling in all parts of the country. It is desirable to have figures for around 200 localities rather than only 25 or 30.
3. The cost of manufacturing articles must be studied so that in buying from the manufacturer it can be stated (for example) that a stove of such and such a kind is wanted at such a price, with the certainty that the manufacturer can furnish that stove at a profit.
4. In studying the material, style and workmanship which should go into an article, it is especially valuable and entirely practicable to determine roughly what per cent of the cost of the article should go for material, what per cent for style, etc.
5. The mail order business has excellent records of tendencies in styles, materials, colors, etc., which are valuable indices of future trends.

In the course of his discussion, Dr. Snow made a number of interesting suggestions regarding merchandising policy. In sales promotion, the pricing and styling of goods are more important, in his estimation, than advertising. In comparing a department's line with that of a competitor, it is desirable to compare the physical qualities of the goods. In making this comparison, the weight and kind of material are not considered as important as, in the case of an electric iron for example, the ease with which the iron can be handled, whether the point is hotter than the heel, and other such considerations.

Quantitative measurements show that in any one line too wide a variety of prices will produce a smaller volume of sales than a smaller variety with a significant difference between the articles in that line. If the public cannot see clearly why one article is priced differently from another article in the same line, there will be confusion and skepticism.

On December 11, Dr. Herbert B. Simpson, of the Institute of Research in Land Economics and Public Utilities, addressed the Chicago Chapter on the subject, "Taxes in Chicago and Illinois." There were 51 present. Notes on Dr. Simpson's talk follow.

The average relationship of assessments in Illinois to sales value of property was 35 per cent in 1927. This ratio was established by the examination of thousands of

real estate transactions. For purposes of public discussion, this ratio can be called "the level of uniformity." In the recent re-assessment of Cook County property, 37 per cent of full value was adopted as a level at which the assessment of all property would be equalized as far as possible. Previous to the recent re-assessment a great lack of uniformity in the relationship of assessments to sales value existed. The Board of Review, instead of equalizing the assessments made by the Board of Assessors, actually created a greater lack of uniformity. According to the State Constitution taxes must be levied uniformly, and the lack of equality in assessments in Cook County has resulted both in confiscation and in exemption. In 1927 it is estimated that $64,000,000 of taxes were confiscated. By types of property the ratio of assessments to sales value has been very high for office buildings and very low for vacant property.

A similar study of assessments to sales values in Buffalo shows that Buffalo has a much nearer approach to complete uniformity than Chicago.

A study of shifting land values on Michigan Avenue, Chicago, indicates that the effect of public improvements is to increase values in the area adjacent to public improvements, but also to lower them in other sections. The building of the Michigan Avenue Link Bridge and other improvements have actually decreased many real estate values south of Randoph Street since 1910. It is estimated that two-thirds of the increase in value north of Randolph Street is due to public improvements.

Plans are under consideration for the development of an employment clearing house for statisticians in the Chicago area.

The Boston Chapter.—The Boston Chapter held its second meeting of the year on December 16 in the Auditorium of the Boston City Club. Sixty-one members and guests were present at the dinner, and 83 were present at the speaking session. Dinner was served at 6.30 P.M., and the speaking session began at 8 P.M. The presiding officer was Mr. Charles F. Gettemy, Assistant Federal Reserve Agent of the Boston Federal Reserve Bank, and the general topic dealt with "Effects of Stock Market Decline: (1) On Business, (2) On Fiduciary Institutions."

Mr. John P. Sedgwick, of Shaw, Loomis and Sayles, reviewed briefly the development of investment trusts and described the various types. The rapid increase in their number and in the magnitude of their operations was held to be in part responsible for the recent inordinate rise in the price of stocks. In most cases there was a decline of over 50 per cent in the market value of their holdings during the stock market break. Some of these trusts will probably be unable to weather the storm, but those which have been more conservatively managed in the interests of the stockholders rather than in the interests of the management will survive as useful institutions.

Mr. N. E. Peterson, of the First National Bank of Boston, who has made an exhaustive inquiry into the effects of the stock market decline on business, found that it had had a temporary depressive effect which has been offset in large measure by confidence restored as a result of action taken by President Hoover in an endeavor to stimulate business. Funds in speculative channels are now flowing back into general business, and the outlook for business is better than it was last summer. There is no large surplus of inventories, cancellations of contracts have been relatively few, collections are no worse than a year ago, and the volume of retail sales, except with respect to luxuries and semi-luxuries, has shown no marked decline. In his opinion the decline in the price of stocks has not touched the vital spots of our economic life.

Mr. H. R. Bowser, of the Boston Federal Reserve Bank, spoke most convincingly with reference to the effect of the stock market decline on the credit situation. A chronology of events leading up to the break in the stock market prepared by Mr. Bowser was particularly interesting and significant. The saving influence of the Federal Reserve System in the stress of the decline was fully described.

Mr. E. G. Plowman spoke with particular reference to the effect of the decline in prices of industrial stocks on the volume of orders for manufactured products, and presented a chart showing the trend of industrial stock prices, based on the Dow-Jones index, and the trend of the "Index of Orders," computed by the statistician for the Associated Industries of Massachusetts. He called attention to the fact that the recent moderate decrease in orders began as early as August, 1929, and was not the result of the October break in stock market prices, and that the trend of the order curve, while still downward, showed no direct correlation with the curve representing prices of stocks.

The Austin Chapter.—On December 11 the Austin Chapter held the first regular meeting of the academic year. Twenty-eight members and guests were present. Dr. F. A. Buechel, Statistician and Assistant Director of the Bureau of Business Research, University of Texas, addressed the meeting on "Statistics as an Aid to the Analysis of Egg Prices." Dr. Buechel used as the basis of his discussion a manuscript, of which he is the senior author, on the subject of egg prices, soon to be issued as a technical bulletin by the Federal Bureau of Agricultural Economics. He outlined that part of the study dealing with the quantitative analysis of egg prices and composed of the following parts:

1. Estimating the prospective average spring price of storage-packed firsts and Pacific Coast white extras.
2. Estimating the prospective average fall price of refrigerator firsts and Pacific Coast white extras.
3. Analyzing and determining the relative importance of the factors which cause the changes in the average monthly prices of eggs.

It was developed that the *direction* of average price changes of eggs in the spring and in the fall in comparison with the price during the corresponding seasons the previous year could invariably be estimated several months in advance. Most of the factors which cause the changes in monthly prices were determined and the respective influence of each measured. It was pointed out, as the title of the address suggests, that quantitative price analyses at best may aid but cannot take the place of good judgment on the part of the dealers in the commodity in estimating the probable course of prices.

The Cleveland Chapter.—The Chapter as a whole has but one meeting each year. However, the Business Statistics Section got under way in October, three meetings having been held. The first was devoted to forecasting the Annalist curve of business for the eight months beginning with November, each member submitting a forecast. At the second meeting there was presented a review of the principal talks given at the Harvard Economic Society's annual meeting in November. The speaker at the third meeting, on December 23, was Mr. E. E. Campbell, who has spent twenty years in India, and whose subject was "The Economic Standing of the People of India."

The meetings this fall have been well attended, with an average of about 20. A number of new members have been taken in.

The Columbus Chapter.—This year an experiment in the nature of a coördinated program is being tried. The general topic selected for the year is "Statistics in Relation to Social Control." The plan is to specialize this general topic for various fields of knowledge.

At the first meeting of the academic year, the principals were Dr. W. W. Charters of the Bureau of Educational Research and Dr. H. A. Toops of the Department of Psychology, the topic for the evening being "An Educational Program for a Quantitative Approach to a New Utopia." The discussion hinged around the possibilities and limitations of the quantitative technique in educational research.

At the second meeting, the topic was, "Shall the Taxing Power of the State be Used to Affect the Distribution of Wealth?" Dr. H. G. Hayes, representing the field of economic theory, Dr. L. E. Smart, representing the field of technical statistics, and Dr. H. F. Walradt, representing the field of taxation theory, were the principals. A lively discussion followed the presentation of the leading papers.

Activities of the Los Angeles Chapter.—On October 2, 1929, at a dinner meeting, the members were addressed by Mr. Jack Lasnyck, Statistician of the Los Angeles Stock Exchange, on "Statistics of the Los Angeles Stock Exchange." Questions and discussion followed the address and a great deal of interest was evidenced in the subject by the twelve members present.

A very interesting paper was presented at the meeting of November 13 by H. A. Perryman, Statistician of the Los Angeles Railway Company, on "Some Recent Trends in Street Railway Travel." Mr. Perryman presented charts showing extreme differences in seasonal variation in street railway passengers in many of the large cities of the United States and Canada. He explained problems and methods of forecasting revenue passengers of the Los Angeles Railway Company.

On December 13, 1929, a social meeting was held at the Beverly Hills Club, Beverly Hills, at which sixteen members and guests joined in volley ball, dinner, and cards. At the annual business meeting held on the occasion the following officers were elected for the ensuing year:

President, J. V. Carson
Vice-President, Ira N. Frisbee
Treasurer, J. L. Niceley
Secretary, J. C. Clendenin
Editor, J. R. Douglas
Counselors, George Ellis and
Arnold T. Anderson

United States Bureau of Labor Statistics.—Information on the incomes and expenditures of the families of 506 Federal employees in Baltimore, Boston, New York, Chicago, and New Orleans in the year ending June 30, 1928, was collected by the Bureau under an arrangement made with the Personnel Classification Board in connection with a study made by that Board of comparative wages of Federal and private employees in cities outside of Washington. A series of articles on various phases of the Bureau's study has been published in the *Labor Review* and a separate pamphlet has recently been prepared bringing these articles together.

An article showing the salaries of firemen in large cities, based on a special inquiry made by the Bureau as to wages paid in fire and police departments, was published in the December *Labor Review*. A similar article for police departments will be published later.

With the November issue of the *Labor Review* the Bureau began the publication of data showing recent wage changes in the United States. This information is derived from two sources: First, the reports of those manufacturing establishments which furnish the Bureau with figures in regard to volume of employment and pay rolls, and, second, reports from trade-unions, conciliators, and others regarding wage changes which have come to their attention. The information thus obtained, while by no means absolutely complete for the country, is sufficient, it is believed, to indicate fairly accurately the trend of wage changes for the major industries.

In addition to the regular monthly reports as to volume of employment and pay rolls, a large number of establishments have been requested to report weekly for two or three months as to the number on their pay rolls. It is expected that most of the establishments will be able to furnish this information, which will throw an interesting light on the question of variation in employment from week to week.

Building permit figures are now being collected and published monthly instead of semiannually as heretofore. The first monthly report appeared in the November *Labor Review* and covered the months of August and September, 1929.

Data on wages and hours of labor in the slaughtering and meat-packing industry were collected by the Bureau during the last quarter of 1929. Summary figures from this study will be published in a forthcoming issue of the *Labor Review*.

Field work on the studies of wages and hours of labor in the furniture, airplane, and cement industries was continued during the quarter.

The history of wages in the United States from colonial times to 1928, which had been in preparation for some time, has been published. The first part of this report, dealing with the colonial period, contains considerable new material. The latter part contains no new material and represents merely the effort of the Bureau to digest and coördinate the numerous wage studies of the Bureau made during the past forty years.

The President's Research Committee on Social Trends.—President Hoover has appointed a committee to study significant social changes in American life. This committee is made up as follows: Dr. Wesley C. Mitchell of Columbia University, Chairman, Professor Charles E. Merriam of the University of Chicago, Professor William F. Ogburn of the University of Chicago, Professor Howard W. Odum of the University of North Carolina, Mr. Shelby M. Harrison of the Russell Sage Foundation. Professor Ogburn was appointed director of the investigation, Professor Odum, assistant director, and Mr. E. E. Hunt, executive secretary. The study will include a description of measurement of the trends of social changes in a fairly wide variety of social fields such as population, inventions, communication, the family, the church, etc. The purpose of the work is largely fact finding with the idea of uncovering problems that it is feasible to deal with practically at the present time. The committee will be known as the President's Research Committee on Social Trends and will be expected to furnish information which may be of guidance to the President in policy-making.

United States Personnel Classification Board.—The survey of wages and personnel policies conducted last year, the results of which were reported to Congress (House Document 602), is at this time being supplemented by a second investigation. The wage information being gathered is confined to routine office workers and certain custodial employees. The survey activities of the Board are in charge of William H. McReynolds, Assistant Chief, United States Bureau of Efficiency, Director; Wilson E. Wilmot, Assistant Director; and Dr. George W. Hervey, Chief Statistician.

The Dedication of Chicago's Social Science Research Building.—The Social Science Research Building at the University of Chicago was dedicated on December 16 and 17, 1929. The building will house the research activities of the Social Science Departments, including: Philosophy, Sociology, Anthropology, History, Economics, Political Science, and the School of Social Service Administration. It will also house the six Social Science Journals published by the University of Chicago Press, the *American Journal of Sociology*, the *Journal of Political Economy*, the *International Journal of Ethics*, the *University Journal of Business*, the *Social Service Review*, and the *Journal of Modern History*.

The building was designed and will be used for research purposes exclusively. It contains four seminar rooms, one lecture room, an extensive statistical laboratory, an anthropological laboratory, and a personality laboratory. Special equipment has been secured for these three laboratories.

The remainder of the building is given over to studies and workrooms where will be prosecuted the various studies supported by the Local Community Research Committee.

The dedication ceremonies were attended by Sir William Beveridge, Director of the London School of Economics and Political Science, by Professor Albrecht Mendelssohn Bartholdy of the University of Hamburg, by Célestin Bouglé of the Sorbonne, and by representatives of seven University Social Science Councils. These included: Wilson Gee, Institute for Research in the Social Sciences in the University of Virginia; Howard Odum, Institute for Research in Social Science in the University of North Carolina; Murray S. Wildman, Stanford University Council; Max S. Handman, University of Texas Council; Donald Slesinger, Yale Institute of Human Relations; Arthur M. Schlesinger, The Milton Fund of Harvard University; and Wesley C. Mitchell, Columbia University Council.

Papers were read by these delegates and by Professor Wesley C. Mitchell, Columbia University, "The Function of Research in the Social Sciences"; by Dr. John C. Merriam, President of the Carnegie Institution, "Significance of the Border Area between Natural and Social Sciences"; by Dr. Milton C. Winternitz, Dean of the Yale Medical School, "Research in the Medical and Social Sciences"; by Dr. Harold G. Moulton, President of the Brookings Institution, "Coöperation in Social Science Research"; by Professor Franz Boas, Columbia University, "Some Problems of Methodology in the Social Sciences"; by Beardsley Ruml, Director of the Spelman Fund, "Recent Trends in the Social Sciences"; and by Professor C. Judson Herrick, "The Scientific Study of Man and the Humanities."

Dedication ceremonies were concluded at the Autumn Convocation at which the convocation address was given by Dr. Edwin B. Wilson, President of the Social Science Research Council, who spoke on the subject, "What Is Science?"

Honorary degrees were conferred upon Professor Mitchell, Professor Mendelssohn Bartholdy, Professor Bouglé, and Sir William Beveridge.

Further Studies of the Milbank Memorial Fund.—In collaboration with the Office of Statistical Investigations of the United States Public Health Service, the Research Division of the Milbank Memorial Fund has begun an epidemiological study in a rural area of Cattaraugus County, New York. It is planned to observe a rural population of between 5,000 and 10,000 persons for a period of several years, collecting information on the incidence of disease, birth- and death-rates, and information on the fertility of women in the present generation and for two generations past, etc., in relation to a social and economic status. A similar study will be begun in certain sections of Syra-

cuse, New York, in 1930. In the Cattaraugus County area the study will be coördinated with an epidemiological study of tuberculosis which will be conducted by the Research Division of the Milbank Memorial Fund.

A Statistical Course for Workers in the Bell System.—An interesting experiment in organized group training of college graduates for work in the field of business statistics in the Bell System was conducted last summer under the supervision of the staff of the Chief Statistician of the American Telephone and Telegraph Company. This staff assembled in New York a group of fourteen men specially selected from the 1929 graduating classes of a number of colleges and universities, and organized a course of training, covering a period of three months, designed to give the men a broad picture of the telephone business and its statistical problems and to acquaint them with the principal statistical techniques involved in the solution of these problems. The course covered, in general, the ground indicated below.

First, the men were given an introductory course dealing with the general aspects of the telephone business, the history and corporate structure of the Bell System, the relationships existing among the various corporate units of the System, and the organization and functions of the various departments of these companies.

In view of the fact that a large part of the statistical problems actually arising in the business involve accounting data, instruction was given in the system of telephone accounts and the various financial and accounting reports were reviewed. After completing these subjects, attention was directed to the scope of statistical work in the Bell System, and statistical methods which have been found applicable in telephone work were studied.

Consideration was given to the problems involved in the presentation and reproduction of statistical analyses and in the use of graphic methods. The theory and technique of mathematical analysis of time series were treated at some length. Emphasis was placed on the use of mathematical analyses as aids in interpreting current performances and in forecasting future results, consideration being given to the potentialities and the limitations of this method. Instruction was given in the use of the principal methods employed in measuring seasonal variation and methods of fitting various types of trend curves.

The students were also given a broad understanding of the purpose and scope of economic statistics in the Bell System. Consideration was given to the character and availability of series of economic data and to methods of analysis as well as to methods of constructing composite indexes and the determination of appropriate bases of weighting. Finally, the technique of writing business reports was reviewed.

The Buffalo Study of Unemployment.—The results of a special study of unemployment in nine areas in Buffalo has been announced by Frances Perkins, Industrial Commissioner of New York State. Preliminary plans for this study were made last April and it was carried on through coöperation of the State Department of Labor, State Teachers College of Buffalo, University of Buffalo, Canisius College, and the Buffalo Foundation.

The study was made and the report prepared under the direction of Fred C. Croxton and Frederick E. Croxton. Information was secured through a house to house canvass made by students in the two colleges and the University. The enumeration was made during the first week of November. Fifteen thousand one hundred and sixty-four persons were included in the study.

The hope is expressed that the Buffalo study may be repeated at the same season of the year for a series of years and that similar series of studies may be made in other

cities of the State. The Buffalo survey was carried on in much the same fashion as were the surveys in Columbus, Ohio, during the four years 1921 to 1925 inclusive, the results of which were presented in Bulletin No. 409 of the United States Bureau of Labor Statistics.

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REVIEWS

Recent Economic Changes in the United States, prepared by the National Bureau of Economic Research. New York: The McGraw-Hill Book Company. 1929. 2 Vols., xxx, 950 pp.

Professor Edwin F. Gay, in his admirable introduction to this imposing pair of volumes, expresses the hope that "the range of social vision may be widened and the sense of direction in economic and social change may be surer as a result of such periodic surveys" as this one, which set itself the task of "bringing together in summary form the best information it could find as to the recent economic experiences of the United States." The amount and the quality of the discussion which the study has already evoked from quarters representing opposite poles of vested economic interests, are sufficient evidence that this hope has begun to be realized; and the virtually unanimous praise which has been showered on it from those same quarters is sufficient evidence that the intention of the sponsors of the report to present their material "as objectively as possible" has in fact been adhered to.

That a debt of gratitude therefore is owed to the National Bureau of Economic Research by all those who find in the successive individual chapters of the study, and especially in Professor Wesley Mitchell's masterly "Review" of the findings, a challenge to formulate on their own account new prophecies as to the future of the American economic structure, and new policies with respect to its control and possible modification, goes without saying. Yet it would be too great a concession to the modesty of the sponsors of the report to pretend that these volumes have significance only in so far as they may provide guidance towards the next steps in economic practice. The study is presented under the auspices of one of the leading agencies for institutionalized research in economics; it deserves to be evaluated as an earnest of what such research can accomplish towards the further development of economic science when properly guided and controlled.

The case for institutionalized research rests, in the first place, upon the assumption that there are certain tasks which are worth doing that can be done by an organization specially financed and specially manned for the purpose, with a thoroughness and a competence that is beyond the resources of the individual worker. The history of institutionalized research in economics, brief as it has been, has already provided unfortunate instances which have violated both the criterion that the task must be "worth doing," and the presupposition that competent direction will assure, in the material presented, a maximum of relevance to the problem in hand. Yet, for one who would renew his faith in the ultimate possibilities of institutionalized research, it is not necessary to do more than to compare the quality of these two volumes with that of earlier volumes purporting to answer the same kind of question. The difference between this study and, say, the *Recent Economic Changes* of David A. Wells, or Porter's *Progress of the Nation*, is surely to be attributed to something more than the increase in the

amount of statistical material available and the general advance in an understanding of economic phenomena between their day and ours. If it be argued, on the other hand, that it is unfair to compare the work of routine journeymen like Wells and Porter with the work of trained economists of the calibre of the men who collaborated in the preparation of the chapters in these volumes, it may be retorted that it is precisely one of the merits of wise direction of institutionalized research that it will try to summon the best hands and brains available to the accomplishment of tasks which otherwise would fall to the tender mercies of the less scrupulous and the less competent.

There is, however, another, although less immediately obvious way in which institutionalized research should, and may be expected to, foster the progress of our science. The really capable isolated worker, unable to employ research assistance, tends naturally to concern himself with a type of problem which is amenable to entirely deductive treatment. Or else, where something more than a purely theoretic treatment is possible, he contents himself with something considerably less than not only the actual statistical measurement of the variables involved, but even the precise description in realistic terms of those variables, in such wise that subsequent statistical research may take up the work from the point at which he left off. That the greatest advances in our subject have come from the work of just such investigators, is not to be denied; but it is just as impossible to deny that their achievements might have been still greater, had they been confronted by the challenge to prove the usefulness of the tools which theory had discovered, by applying them to concrete historical situations. The very existence of opportunities for the measurement of social phenomena which is provided by institutes of economic research, represents, in other words, a continuing incentive to develop our theoretical apparatus in a form which will provide the rubrics for statistics to be collected *de novo*, or to be reworked for the special purpose in hand.

No one, I think, who is not entirely devoid of theoretical interest, can turn the pages of these two volumes, concerned as they are with the recording of recent economic events, without wondering how far our theoretical apparatus, in its present form, is capable of explaining those events. It is true that in many cases our theoretical apparatus, even in its present form, will go further in this direction than many skeptics might be prepared to admit. There is much, for example, in the chapter on "Price Movements and Related Industrial Changes" (Volume II), which can be partially, if not entirely, explained by some of the more elementary propositions of pricing- and cycle-theory. Yet it would be folly to deny that there is much, in this as in other chapters, for the explanation of which our present theory is simply not adequate.

It would require more presumption than this reviewer possesses to undertake to show just how, in each of these chapters, the contact with reality, which is generated by interest in explaining actual historical events, throws up, to anyone who takes seriously the economic theory he has been taught, a host of suggestions which clamor for admission into our arsenal of analytic tools. If the chapter on "Money and Credit and their Effect on Business" (Volume II) is taken for illustration, this is done, not by way of implying that the authors of the chapter

in question have been either more or less successful than their collaborators in throwing up suggestions, but only because certain studies, not yet published, have made the reviewer more alive both to the merits of, and the difficulties associated with the suggestions in this chapter than he is to those in the others. At any rate, it is possible to defend the proposition that, with respect to the single problem of the forces determining the *rate of interest*, most of the interest-theory which is currently expounded in the textbooks is not framed in such a way as to take account of the following phenomena, which are discussed or hinted at by the authors of the chapter as having had definite influence during the period in question: (1) the mechanism of interrelation between the different markets for money-loans (p. 659); (2) the influence of the establishment of the Federal Reserve System on interest rates in general (p. 663), as well as upon the problem, just mentioned, of the interrelation between the different markets; (3) the relative importance of commercial banks as suppliers of loanable funds, as compared with other suppliers, and the nature, as well as the extent of their influence (pp. 664 ff.); (4) the influence of the internal and external drains—particularly the former (pp. 670 ff.) upon interest rates; (5) the precise nature, as well as the extent, of the effect of corporate savings upon the supply of loanable funds and interest rates (pp. 672 ff.); (6) the actual facts with respect to the amount of savings contributed by income groups, classified both as to size and as to what Professor Fisher has called the "time-shape of the income-stream"; (7) the relationship between the velocity of circulation of bank-deposits and savings (pp. 674 ff.); (8) the effect of both upon the lending power of banks (pp. 676 ff.); (9) the effect of the rate of interest upon the velocity of circulation of bank-deposits, and so the lending power of banks (p. 678); (10) the effect of government debt-reduction upon the supply of loanable funds (pp. 679 ff.); (11) the different effects of foreign and domestic investment upon the supply of loanable funds, and so the rate of interest (p. 680); (12) the effect of new methods of financing upon the position of business units as suppliers of loanable funds (p. 682); (13) the influence of the stock-market on the interrelation between the different markets for money-loans (p. 684); (14) the effect of the "absorption" of credit by the stock-market upon the demand for loanable funds, and so the rate of interest (p. 687); (15) the effect of a decrease in the number of banks upon the supply of loanable funds (p. 693); (16) the effect upon the general level of interest rates of the actual operations of the Federal Reserve Banks, during the period in question (pp. 696 ff.). That all these factors, and others besides, have been taken into account by writers on current conditions in the money-market, and, to some extent, by writers on monetary theory, I should be the first to admit; that they have been given adequate attention in formal treatises on the forces determining the rate of interest, seems to me a proposition without foundation.

The day will come when such a divorce between the theory of the textbooks and the observation of the facts of the market as is here recorded, will be inconceivable. When the day comes, it will have to be set down to the credit of such organizations as the National Bureau of Economic Research that they were among the first to have acted in the direction of bridging the gap: First by producing admirable and challenging studies, such as the one under review, of actual

economic tendencies in recent years; and secondly by tendering, through the very fact of their existence, a continuing invitation to individual workers to bring their labors to a point at which organized research assistance becomes not only desirable but actually necessary if the work is ever to be brought to proper fruition.

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Crossroads in the Mind of Man, by Truman L. Kelley. Stanford University Press, California. 1928. 236 pp.

Crossroads in the Mind of Man is beyond doubt a very notable product in the history of individual psychology; and it can only be understood aright in its historical setting. For many years there have been ardent advocates for what is now sometimes called the method of factorization, as exemplified in the well known analysis of every ability into two factors, the one general and the other specific, or "g" and "s." The fundamental principle is, first to resolve the observed abilities into factors obtained statistically, and then to find out what these factors signify psychologically. Thus, paradoxically enough, one first gets a measurement, and then ascertains what it measures! Now, this whole procedure, together with the system of psychology evolved by its means, had throughout been strongly opposed, chiefly by Thorndike and his school. Nevertheless, the members of this school had rarely, if ever, attempted open argument against it on general mathematical grounds; their resistance, for all its stubbornness, had been mainly passive. And this attitude on their part had plausibly enough been attributed to their confidence in having behind them all the time the mathematical authority of Kelley. Indeed, this confidence was not without some justification. For even as late as his book published in 1927, Kelley leaves all factorization severely alone. But in the present book of 1928 there comes a startling change. Factorization is no longer banned by him, but enthroned.

Taking first his general account of the situation, the most noticeable feature is a curious wavering in his demeanor towards those who had been supporting the factors all along. At times he gives some just and even generous recognition to their work. But more often he regresses into a strangely hostile tone towards them. This hostility is also shown in what I can only call serious omissions and even misrepresentations, both historical and doctrinal. For instance, he writes as if all our main work was not published till 1927,[1] and therefore had run its course almost parallel with his own; he never hints that the main outlines of the theory of two factors, together with the concept of "general intelligence" or "general ability" as a measureable quantity, had already been given by the present writer in 1904.[2] Nor does he mention that the extension of this theory of a single general factor into that of several general factors had been effected by Garnett in 1919.[3] Even the probable error of the "tetrad differences" had been given by Holzinger and myself in 1924.[4] Again, he states that I have at various

[1] That is, in *The Abilities of Man*, by C. Spearman.
[2] *American Journal of Psychology*, XV.
[3] *Proceedings of the Royal Society*, A, Vol. 96. Also, *British Journal of Psychology*, IX.
[4] *British Journal of Psychology*, XV.

times employed "quite a number of criteria" for the factors, whereas in place any such vacillation, my fundamental criterion is today exactly what it w originally in 1904.[1] He again and again reproaches me with considering too small a number of subjects; although really, my largest number on any one occasion seems to have been about twenty times the largest here brought forward by himself, and my total number about thirty times his total number! He charges me repeatedly with having throughout neglected to partial out such influences as age, sex, and so forth; whereas, to the best of my knowledge, this very partialling was actually introduced by myself originally, and has been continually employed by my students and myself ever since.[2] And these are only a few out of the many points on which our work appears to us to have been quite other than as he describes it. In general, he gives no notion of the collective magnitude and the systematic completeness of our work, both on the psychological and the statistical sides, as built up by a very large number of researches made by very numerous investigators through a great many years.

But enough on this unfortunate personal note. The next portion of Dr. Kelley's work gives us, instead, positive contributions. He evolves sixteen propositions setting forth various conditions under which a variable can or cannot, from the evidence of the correlations, be "thought of" as due to some number or kind of factors. The first, for instance, runs as follows:

> A number of traits greater than 1 may be involved in the correlation between two mental measures, no matter what the value of the correlation coefficient. (p. 34.)

The fourth is:

> Three variables may be thought of as due to a single general factor plus two specific factors only in case the product of two of the three inter-correlations is equal to the third. (p. 40.)

The sixth is the fundamental one due to Garnett:

> Three variables may be thought of as due to two independent general factors and no specific factors when
>
> $$1+2r_{12}\cdot r_{13}\cdot r_{23}-r^2_{12}-r^2_{13}-r^2_{23}=0.$$

The tenth is the chief one of Holzinger and myself, or rather a part of it (since ours deals with n variables instead of only four, and also includes the much more difficult inverse theorem): (p. 43.)

> Four variables may be thought of as due to one general factor plus four specific factors when
>
> $$r_{12}\cdot r_{34}=r_{13}\cdot r_{24}=r_{14}\cdot r_{23}.$$ (p. 46.)

The last one is:

> If the inter-correlations between four variables are such that one tetrad difference is equal to another one and the third = 0, they could conceivably have arisen from four variables through which was a general factor plus, in addition thereto, a second factor common to two of the variables. (p. 69.)

[1] *The Abilities of Man*, Appendix i-iii. [2] *American Journal of Psychology*, XV, 1904.

These examples will give the reader some notion of this part of the book, and courage him to study it for himself. Such study it well deserves from all statisticians.

Disappointingly but interestingly, however, Kelley has in the present work been able to put these propositions (other than that of Holzinger and myself) to very little practical application. In his own words:

> It fails as a desired technique when the number of factors exceeds three, and it even is insufficient for two or three factors in that it does not tell just where the various factors are located and what are the numerical amount of their standard deviations. On these accounts another method has been developed. (p. 79.)

This brings us to the third chief portion of his work; namely, this other and quite different method which the author does actually apply. It comprises two steps: first, the finding of tentative values for the factors; and then, the refining of these values by the ordinary method of least squared differences.

The first and main step consists in calculating for each pair of variables the mean value of all the tetrad differences involved and then "tentatively assigning factor values so that the bonds, other than that given by a general factor, running throughout all the variables, are largest for those pairs of variables giving the largest mean tetrads." (p. 80.)

We may first note that this procedure does not—as he seems sometimes to claim—dispense with the theory of two factors, as based on the tetrad differences by Holzinger and myself; instead, it assumes our theory as its very foundation. Next, the bare averaging of these tetrad differences was of course at once done by ourselves with the same object as his, namely, to note and compare the general tendencies of each correlation to appear too large to be explicable by the general factor alone. So far, so good. But how does Kelley go on further, and from these indications of surplus correlation proceed to derive a tentative scheme of factors to explain all these tendencies to surplusage?

As regards the first experiment he has occasion to treat in this way, he asks us to take the passage from the surplusage to the factors "on faith," since it "was accomplished by a technique which is both more involved and longer than that used on other populations."

And accordingly, on turning to the next "population," we there do find a description of his procedure. (pp. 117–9.) But surprisingly, it does not appear to be statistical or objective at all; instead, it seems nothing more than a mere guessing on psychological grounds. It may perhaps help towards making interesting psychological suggestions; or, on the other hand, to verify psychological views already suggested. But it is entirely quitting the region of statistical work (such as occurs in measuring and even exploring g or s). And herein no subsequent refinement by means of least squared deviations would appear to furnish the least assistance. Above all things, the result of the whole operation will be no better than the psychology of the operator!

We now arrive at the last portion of Kelley's work. It is where the preceding method is actually applied by him to his own data. His conclusions may be divided into two categories, major and minor. Of the former he writes as follows:

> On the whole the two sets of findings (his own and those of the present writer) are quite remarkably in harmony, the agreements being in the matter of g spatial, a numerical, a memory, and even a general factor, though this last is differently interpreted, and also in the conclusion that a large number of specific motor (probably also sensory) factors exist. There is scarcely a disagreement in the matters of music, purpose, cleverness, and sex, though here the data are inadequate. There does seem to be a real disagreement in the importance and extent of a verbal factor and in that of a mental speed factor. (p. 26.)

And in fact his corroboration of our earlier results is even closer than he represents it. For the supposed disagreement about the mental factor speed seems only due to his having misunderstood what I wrote about it.[1] And even as for the "verbal" factor, this too he is taking in a sense different from mine.

When, however, we turn to his minor conclusions, such as are not mentioned by him in the preceding summary, they do not indeed flatly contradict our work, but at least they put forward several conclusions that we had not reached. What is much stranger, a large proportion of these additional results would seem to be essentially irrational. The following is a typical instance: He finds that a test specially constructed by him to depend upon speed is actually correlated with his "speed factor" inversely! Furthermore, these new factors of his appear to be quite superfluous. Holzinger and his students have shown that these very data are perfectly explicable in a far simpler fashion by the theory of two factors as ordinarily handled.[2]

If we seek to explain all this discrepancy, irrationality, and superfluity of his results, one great cause would seem to be the above described insecurity of his method, including its lack of probable errors. But perhaps there is an additional and even more fundamental cause, his attitude towards probable errors in general. He seems to regard an observed result as significant when it is about twice the size of the relevant *P.E.* (p. 215); or even when it has a still smaller ratio to it. (p. 214.) Now in my own opinion, a result as large as twice the *P.E.* by the laws of probability may be expected to occur by mere chance about once out of six times. Therefore in a table of, say, 200 tetrad differences, results of this size ought by mere chance to occur thirty times or so. To regard all these results as significant would be to choke up the records of science with errors. One ought, I maintain, to be most strict in admitting any positive result to be significant. Yule's rule is by no means too severe, when he lays down three times the sigma or about four and a half times the *P.E.*

On the whole, whoever contemplates reading Kelley's book must be cautioned in two respects. The first is that his account of other workers in the field is repudiated by themselves, as being more than colored with partisanship. The other is that both the method and the results of his own research as recorded in the book should be received very critically. But with these two warnings, the book can be recommended, and even strongly, to all statisticians. In particular, his sixteen propositions (pp. 34–79) appear well worth study and further development.

C. SPEARMAN

[1] *The Abilities of Man*, Ch. XIV. [2] *Journal of Educational Psychology*, 1929, p. 91.

Farm Cost Studies in the United States, by Merrill K. Bennett. Stanford University, Food Research Institute, Miscellaneous Publications No. 4. 1928. xv, 289 pp.

This book is a somewhat severe criticism of the procedure of agricultural economists in gathering and using farm cost data. Their methods of collecting such data are unnecessarily expensive; the data which they get are insufficiently representative to be usable; there is a generally inflationary bias in their farm cost data; in many cases there is no clear notion of what purpose they are to be made to serve and no purpose which they can conceivably serve. In part these defects are due to the fact that their collection is not by individual farmers for their private purposes, but by government agencies operating at the public's expense, who are free, therefore, from the constant pressure to show results proportionate to their efforts to which the costing service of private industry is presumably subject. The statistical methods by which these data are analyzed are either too simple and crude to give usable results or are too refined and difficult both for those who supply them and those whom the analyses are intended to serve. Finally, there are serious defects in the manner of collection and use of farm cost data which are attributable in large part to the insufficient knowledge and use by farm management experts of economic theory with respect to the relations of costs to price.

This indictment is probably warranted and, accompanied as it is by many constructive suggestions which seem to be sound and practicable, should prove valuable if those to whom it is addressed pay any attention to it. I strongly suspect that similar profit would accrue from similar scrutiny of the extensive mass-research in other fields which is the outstanding characteristic of present-day effort in American economics. I would feel somewhat uncertain, however, about the product which farm management experts would derive from the application of the economic theory which the author expounds for their benefit, even if it were logically impeccable. As in some respects it is involved in confusion and error, it would perhaps be just as well that they should continue innocent of knowledge of economic theory as here presented.

Space limitations permit only a brief summary of the inadequacies of the author's theoretical analysis. The allocation of joint costs must rest on an arbitrary principle from the point of view of serving as a guide to farmer behavior (p. 49) only if the relative proportions in which the joint products shall be produced are not at all within the control of the producer, a situation which I understand is extremely rare. After the correct assertion that "economists in their discussions of cost and price relationships under freely competitive conditions . . . say nothing about fair prices," there follow statements that the economists do call competitive prices "fair." (p. 186. See also, pp. 219–220.) The author says that "Economists do not include rent of land as an element of cost," and that "they deny that in the long run the volume of supply would be affected by cost calculations of individuals involving consideration of the amount of rent." (pp. 190, 192.) I do not know of any economists who deny that rent is a part of entrepreneurs' costs, and there are probably many more economists of standing who assert that rent is as much a price-determining cost as any other

cost than who deny it. Although I am old-fashioned enough still to maintain that there is an element of truth important enough to be worth salvaging in the Ricardian doctrine, I cannot see any reason why any economist should deny that the rent which land could yield as corn land may affect the extent to which it will be used for wheat and therefore the supply and price of wheat. The author's exposition of economic rent and marginal costs is vague. (pp. 190 ff.) Marginal costs enter into the determination of rent only if price equals marginal cost, and even then rent is not the sum of the differences between marginal cost and other costs, but is the difference between marginal cost and average cost, exclusive of rent, times the number of units of output. When x units are produced, the marginal cost is the increase in aggregate costs of x output as compared to $x-1$ output. Given the output, and the only costs which are distinguishable are the marginal cost and the average costs, farm and crop as a whole. If in an actual year a, there is an output x, and in year b an output $x+1$, the excess in cost, if any, of the second output over the first, has no direct bearing on the amount of rent. Fixed costs, to the extent that they are really sunk costs and therefore inescapable and invariable in their aggregate amount regardless of output, do not affect marginal costs, and the same results as to marginal cost will be obtained from a calculation which does and one which does not take them into account. (pp. 203–204.) As the author says: "The general concept of marginalism is by no means easy to grasp."

There is a discussion of "bulk-line" cost curves which is a distinct improvement over most of what has been said about them, but it is not free from error. The statement: "A particular point on a cumulative curve of wheat costs means . . . that a certain proportion of the total amount of wheat grown on the farms under investigation was produced at a cost of $2 per bushel" to be correct should be amended to read: "was produced at a *farm-average* cost of $2 per bushel *or less*." The theorist need not assume close correspondence between normal price and marginal cost even in a static state, if he grants that even in such a state error, weather variations, etc., would occur. The bulk-line concept—the "statistical" or "accountants'" cost curve, or Marshall's "particular expenses" curve—is usable even in long-run static analysis. Under static conditions the personnel of the extra-bulk-line group of producers would be ever-changing, but the group would be permanent. (pp. 198 ff.) Granting the author's assumption that in the long run price equals marginal cost, it is an erroneous proposition that: "Crops, like oats, which from the point of view of maintenance of soil fertility and employment of available labor fit well into a rotation centering about corn . . . would continue to be produced despite cost and price discrepancy." This is like the argument for a tariff on beet sugar because beet-culture enriches the soil for other crops. Rotation of crops makes the different crops joint products, and demands determination of the rotation on the marginal cost principle, as Longfield pointed out almost a hundred years ago. Price-fixing at the bulk-line cost does not find its justification in the substitution, for the output of the displaced extra-bulk-line producers, of increased output of the other producers (p. 225), for without an increase in price there is no inducement to them to increase their output, and without a decrease in price there is no reason why the extra-bulk-line

output should decrease. The bulk-line analysis, correctly interpreted, does not "locate a price-determining cost," but locates a price which is consistent with maintenance of existing output. It locates a *point* on the supply curve which corresponds to the prevailing price and the prevailing output. What the bulk-line point is, and if it has stability, could be determined only by collection of bulk-line cost curves over a series of years. In this connection, it should be pointed out that land-rent is an equalizing cost through a conceptual or *timeless* long run and not, as the author has it, through a long *historical* period (p. 254), which he confuses with the economist's long run. The bulk-line comparison of costs in different countries for tariff purposes does not necessarily lead to a higher duty than the comparison of average costs. (p. 256.)

JACOB VINER

The University of Chicago

Studies in the History of Statistical Method with Special Reference to Certain Educational Problems, by Helen M. Walker. Baltimore, The Williams and Wilkins Company. 1929. viii, 229 pp.

At this time, when the history of science is assuming more and more importance, Dr. Walker's book is especially welcome. That not all statisticians have an adequate knowledge of the history of their own *Fach* may be suspected from her note on recent discussions as to which of our contemporaries invented the "gross score" formula for the standard deviation, a formula first published by Encke in 1832. As its name implies, the book is not a general history of statistics, the development of official administrative statistics being merely sketched. Nor does it cover the development of all phases of statistical method. Nevertheless, we may be grateful to Dr. Walker for an excellent treatment of the history of some of the more important topics, especially the normal curve and correlation. Those who have been accustomed to think of the normal curve as due to Gauss and have painfully adjusted themselves to the realization that Laplace had treated it before him must now again adjust themselves to the discovery by Pearson that De Moivre had derived it some time before 1733. The sections on abscissal units of the normal curve and tables of the normal probability function and the bibliography of memoirs on the probable errors of frequency constants are also especially valuable.

In the chapters on correlation Dr. Walker shows how Laplace, Plana, Gauss, and Bravais all derived the normal correlation surface from the viewpoint of the probability of the simultaneous occurrence of two errors, but it remained for Galton to grasp the idea implicit in it of a measure of the relationships between two variables. The account of the gradual development in Galton's mind of the concept of correlation, told in large part in his own words, is as dramatic as any in the history of science. His measure of correlation was the slope of the regression lines, fitted to the medians—not the means—of the arrays, and expressed in terms of the semi-interquartile range. Pearson was the first to introduce the present product-moment formula. At the end of the chapter is an annotated

bibliography of memoirs relating primarily to measures of correlation other than the product-moment.

The chapter on statistics as a subject of instruction in American universities traces its development from the first course, taught by Mayo-Smith at Columbia in 1880, through the work of Cattell at Pennsylvania and Columbia, of Boas at Clark and Columbia, of Scripture at Yale, of Titchener at Cornell, of Glover at Michigan, of Rietz at Illinois and Iowa, of C. B. Davenport at Harvard and Chicago, and of Thorndike at Columbia, to the present time when "almost every university in the country and most of the larger colleges have at least one or two courses in statistics, while some of the larger universities offer from ten to twenty-five courses in five or six different departments." Dr. Walker's interest in educational statistics is reflected in her selection of names for special consideration. The influence of Pearson on educational statistics in America is emphasized. There are also shorter treatments of the history of moments and percentiles, an annotated bibliography of Spearman's Theory of Two Factors, a list of technical terms used in statistics with notes on their origin, a bibliography of sources consulted in the preparation of the study, and an index.

In spite of the motto of its publishers, the book is not altogether *Sans Tache.* Besides minor typographical errors, in the account on page 23 of Gauss's derivation of the normal curve "K must be negative" should be k; Achenwall was *Privat Docent* at Marburg, not Marlborough; John's work *Der Name Statistik* is an *Etymologisch-historische Skizze*, not "*Entomologisch*"; the registration of deaths in England was begun by Henry VIII, not Henry VII; De Moivre proposed the term Modulus in 1738, not 1838; in note 21, on page 75, $\frac{\Sigma x^q x'}{N}$ should be $\frac{\Sigma x^q y'}{N}$; and in the discussion on page 79 of Rhind's tables to facilitate the computation of the constants of skew frequency distributions $\frac{\sigma}{\sqrt{N}}$ should be $\sqrt{N}\sigma$.

JOHN R. MINER

The Johns Hopkins University

Unemployment Insurance in Germany, by Mollie Ray Carroll. Washington: The Brookings Institution. 1929. x, 137 pp.

Miss Carroll's study of German unemployment insurance, begun in 1927 when she held a fellowship from the Guggenheim Foundation, is a timely contribution. As one country after another extends its legislation by the various measures known collectively as social insurance, the interest of the statistician centers in the extent to which the insurance principle is actually employed, that is, the extent to which a risk is measured and a fund built up to cover it. It frequently happens, as in the case of unemployment, that considerations of public policy, as well as the nature of the risk itself, lead to almost complete abandonment of the principle.

England, the pioneer country to establish national unemployment insurance,

is in the process of revamping her system amid the very perils of industrial bad weather which necessitate a remedy. Russia, divided between the desire to establish economic security for the workers of today and reluctance to tax industry in a way which might retard her ambitious industrial programs, has repeatedly pared down the contributions which industries must pay with resulting deficits in the insurance funds. France, the last nation to undertake a comprehensive scheme of social insurance, had too many qualms about the whole matter and too small an amount of unemployment to give it any place in her law. Germany, forced to give unemployment first consideration and long inured to the social insurance idea, adopted a method which is more "purely" insurance than that of any other country.

Although Germany's national system was not established until the passage of the act of July, 1927, Miss Carroll treats it as the culmination of experience through the whole of the post-war period. Even before the War private and local public bodies had undertaken experiments which by 1918 had developed all the major elements of systematic aid to the unemployed. But it was the enormous problem of re-absorbing into industrial life the millions of demobilized soldiers and war-workers which brought about the passage of the new legislation. Added to the problem of dealing with these hordes, released from jobs which had come to an end, were other factors disturbing employment. Stabilization of the currency had meant not only the loss of individual savings which set people who had never worked before to hunting jobs but it had brought about the loss of domestic and foreign markets and so disturbed production. Reparation payments increased the difficulty of the country's economic recovery, while the adoption of "rationalization" with its new methods of production meant a further displacement of labor.

The Government, not having as yet devised insurance machinery, was forced to deal with unemployment as a relief problem. In the meantime, the political balance of power had shifted to the very classes most exposed to unemployment, the workers and the ex-soldiers, who, in the nature of things, could not be allowed to have pauper status. Out-of-work benefit funds were created by requiring contributions from all those who were covered by the compulsory health insurance system and by their employers, but both of these groups objected to the parts given them on the ground that the benefits were relief, pure and simple, available only for those in actual need, so that a worker's payment gave him no claim to the fund he helped to create. Consequently, it was the insurance principle, rather than relief, which was preferred and this was made the basis of the law drafted by the Ministry of Labor after years of study including six months devoted to an examination of the English system.

The two systems present contrasts. In the English, flat rates are fixed for both contributions and benefits. The German workers and employers, on the other hand, contribute three per cent of the wages bill. It is provided that, after a sufficient national reserve has been established, the three per cent rate may be lowered in any district where there has been an excess of income over demand for three consecutive months.

Although the normal costs of unemployment insurance are met by these con-

tributions, special assistance, including something akin to the English "extended benefits" are covered by sums drawn from the public treasury. The standard benefits (paid out of the workers' and employers' contributions) are percentages of the worker's former pay. These range from 75 to 35 per cent, according to the wage class he belonged to, on the principle that the smaller the wage, the higher the per cent of it which comes to him as unemployment benefit. Thus the workers in the lower wage classes derive a proportionately greater benefit than those in the higher, the system working out to guarantee the same minimum standard of living during unemployment. Miss Carroll reports that this discrimination causes no dissatisfaction and that "a higher rate in the upper classes is expected to materially reduce costs and is therefore opposed by workers and employers."

All workers in receipt of benefit are entitled to higher percentages of their wages if they have dependents. In this respect the workers in the higher wage groups are apparently better off than those in the lower, for they receive greater increases in the percentages fixed on account of dependents. For instance, a man in the lowest wage class (with a weekly wage of about eight marks) receives 75 per cent of his wage if he bas no dependents, and only 80 per cent if he has five or more dependents. A man in the highest class (receiving a weekly wage of about 63 marks) though he receives only 35 per cent of his wage as benefit if he has no dependents, gets 60 per cent of it if he has five or more dependents.

Miss Carroll regards the variation of benefits between wage classes as one of the departures of the German system from "pure insurance." The fixing of the contribution at 3 per cent of the wage bill, irrespective of the amount of unemployment, is another departure, for the individual employers and industries with stable employment pay no lower rate than all others in the district. The author makes no comment on the statement that "gradation of contributions according to risks of industry produces negligible results in controlling unemployment" and seems to concur in the opinion that "a sliding scale of contributions is futile to stem the tide of unemployment arising from technological changes in industry." When it is recalled how effectively potential unemployment incident to technological changes was controlled in the printing industry in the United States by trade union agreement, room is left for argument as to whether a sliding scale of contributions might not also be effective. Nor is the suggestion convincing that accounting costs incident to a sliding scale would be prohibitive.

The volume contains excellent accounts of the administration of the law, the working of the exchanges through which it operates, and the establishment of "value-creating unemployment relief," that is, employment on public works with wages paid from money furnished by the poor law authorities.

The reviewer found the discussion of the financial aspects of the undertaking somewhat disappointing. Of course the available information on so new an experiment is limited in amount, but one looks in vain for some hint as to the effects of this elaborate provision upon the actual economic status of the working people. The general purpose of the legislation is the substitution of insurance for relief. Some analysis of the changing expenditures for these items might give an indication of the extent to which this purpose is being realized.

The total expenditure for the first year of operation amounted to 980 million

marks plus 122 million from the national treasury for public works. Grants for "creating employment opportunities" absorbed over 14 per cent of this and administrative expenses only 7 per cent. Miss Carroll regards this last item as low when compared with the English administrative expense, but her comparison is made, not with an actual expenditure percentage but merely with the 12.5 per cent mentioned in the English provision which permits any administrative expense above this percentage to be paid out of the state treasury instead of the insurance fund! Moreover, a footnote states that the English expenses have been under this 12.5 per cent since 1922, though no exact figure is given. No comparisons on a per capita basis are attempted.

Some minor items escaped the proof reader and remain to entail confusion. The line graph (p. 12) for the course of unemployment in Germany suffers from an illegible scale which makes the unwary reader assume the numbers of unemployed to have been far in excess of what they actually were and he is further distracted by misprints in the mention of years in the following discussion (p. 16) in which unemployment is spoken of as high in the year where the graph shows it to be lowest. In one or two places, in an endeavor to simplify a quantitative analysis, the character of a distribution is obscured, as when (p. 29) the parts are successively designated as "one person in 20," "about 13 per cent," and "almost two thirds."

In essentials, the study has been made with great care and excellent judgment in the selection of details. It offers to the English reader an invaluable description of the German experiment.

Amy Hewes

Mount Holyoke College

Wages in Practice and Theory, by J. W. F. Rowe. London: George Routledge and Sons. 1928. 277 pp.

After an introductory explanation of how wages are set in five great British industries, namely, building, coal-mining, cotton manufacturing, engineering and the railway service, Mr. Rowe analyzes the movements of money and real wage rates from 1886 to 1926. Building on the excellent work of Wood and Bowley, he computes indexes for typical skilled, semi-skilled and unskilled crafts in each of these industries. The effective purchasing power of a normal week's work was in 1926 in terms of a simple mean of the five skilled crafts approximately 3 per cent more than in 1913; the corresponding increase for the semi-skilled groups was 9 per cent and for the unskilled 14 per cent. The gap between the skilled and unskilled has therefore been narrowing.

Because of the appreciable decline in the length of the working week, the increases in real *hourly* earnings were appreciably more than those given above.

Mr. Rowe recognizes the fact that wage rates are not a perfect measure of the prosperity of the workers since they do not allow for (1) short-time, overtime, penalties and bonuses nor for (2) unemployment. In default of decent statistics on the earnings of the employed workers, he is, however, prevented from treating the former subject adequately while the lack of continuous statistics of unemployment cripples him in that respect as well.

After an illuminating analysis of the changes in skill which have been wrought by the development of new industrial processes, the author passes to a discussion of the changes in collective bargaining during the forty years. In the building trades a national agreement has replaced the old local agreements. One feature is that the wage of the unskilled is not allowed to fall below 75 per cent of that of the skilled. Standardization of wages for similar work had also been accomplished by the railway workers and a national agreement at the time of writing was in operation for the coal-mines. The changes in methods for the cotton and engineering trades were, however, much less striking.

In his final section, Mr. Rowe grapples with the problems of wage theory. Although a "marginalist" of the Marshall-Pigou school, he believes that wages may be increased by (1) the higher supply price which labor will demand because of the protection which unionism and unemployment insurance give to those who refuse to undercut the rates; (2) the pressure which union and Trade Board rates impose upon employers to increase the efficiency of their plants. He is forced, however, to conclude that a "detailed study of these industries does not yield much in the way of definite proof or evidence as to the validity of our theoretical hypothesis." And on this note, this eminently sane and tough-minded but inconclusive work ends.

PAUL H. DOUGLAS

The University of Chicago

Gold and Central Banks, by Feliks Mlynarski. New York: The Macmillan Company. 1929. 157 pp.

Economics is a science of catch-words. The expression "the return of the world to the gold standard" has been responsible for an infinite amount of loose thinking in recent years. The world has not "returned" to any standard; it has definitely cast off from the gold standard; and is in the process of evolving a new standard, in which as yet gold occupies an ambiguous position. This book meets a real need in discussing this evolutionary period.

Dr. Mlynarski (who is Vice-Governor of the Bank of Poland) undertakes to define the actual status of gold in current central banking theory and practice. He describes the essential conflict which prevails in the present world between the gold bullion standard as it exists in parts of Europe (*e.g.*, in England) and the gold exchange standard as accepted, for example, in Austria. Starting from the premise of the need for economy of gold as propounded in Genoa in 1922, he shows the practical difficulties which have confronted a world which attempted to put the Genoa theories into effect by constituting a few "gold centers," with other countries operating a "gold exchange" standard. He traces the gradual recognition of the impractical character of this system, and its evolution into more general (but still imperfect) acceptance of the gold bullion standard. The current form of the bullion standard he regards as imperfect because while several countries (such as France) are clearly abandoning the gold exchange standard to the extent of converting their foreign balances into gold, their attitude toward gold exports is still obscure. While Dr. Mlynarski approves the abandonment of

the gold exchange standard, and the principle of the repartition of the world's gold stock, he is frankly apprehensive that this trend is in the direction of gold hoarding by central banks. Such a development would not merely create a scarcity of gold, but might in the long run turn public opinion away from gold as a monetary basis.

Dr. Mlynarski believes that the world's stock of gold is adequate to support a gold bullion standard, with unrestricted gold movement between a considerable number of "gold centers." At the same time, he proposes that, in order to retain the advantages of a free international movement of gold, but to minimize the volume of physical transfers, each of these "gold centers" should maintain gold deposits under earmark in each of the other gold centers, and sell gold certificates against them in lieu of metal for shipment; these gold deposits to be inviolable in case of war.

Dr. Mlynarski's little book analyzes a problem still generally unrecognized in the United States and neglected by economists, who have been slow in realizing the complex problems in central banking which have arisen in a world which has vaguely accepted gold as its nominal monetary base, but has not clearly defined the implications of its new standards.

ROBERT B. WARREN

Statistics, by William Vernon Lovitt and Henry F. Holtzclaw. New York: Prentice-Hall. 1929. xi, 304 pp.

On account of the publication of an unusual number of textbooks on elementary statistics within the past few years, the reviewer has been interested in trying to learn from the preface of each new book the main reasons for its publication. We find that the book under review "developed over a period of years during the teaching of a first course in statistics." Accordingly it seems that only such illustrative examples have been included as were found by trial to be best adapted to classroom purposes. This trial procedure seems to be an approved pedagogical device. In common with nearly all the recent elementary textbooks in statistics, an attempt has been made to teach methods of handling statistical data by using only a little mathematics and that of a very simple character. The more mathematical parts of the work are deferred to the last chapters of the book.

A feature of the book to which attention should probably be directed is the very early introduction (pp. 16–24) of a chapter entitled "Sampling." The theory of sampling is the most difficult topic of statistics. However, "Sampling" as a chapter heading in this book would be very misleading to one who infers therefrom that the principles underlying sampling fluctuations are developed in the chapter. All that is attempted is to give a brief description of the nature of the sampling problem, and of some of the factors involved in inquiries by sample.

The discussions of tabulation, graphical representation, averages, measures of dispersion, and correlation are presented in a very simple manner well adapted to beginners. The chapter on index numbers explains in brief form the main features of a few of the various types of these numbers with special reference to the

most prominent American types. A very readable chapter including examples from actual data is devoted to the methods of analysis of seasonal and cyclical fluctuations. The book is written in a clear and attractive style.

H. L. RIETZ

The Labor Banking Movement in the United States, prepared by the Industrial Relations Section, Department of Economics and Social Institutions, Princeton University. 1929. 377 pp.

Labor entered the banking field in 1920. By June, 1926, the number of banks had reached a peak of 36, with total resources of $126,356,944. On June 30, 1929, there were 22 labor banks in the United States with total resources of $108,539,894.

Labor banking is still in the experimental stage, consequently it is too soon to pass judgment upon its success or failure as a movement. "In a movement consisting of two score or more enterprises and carried on by a far larger number of organizations and men, the degree of success attained by the movement is difficult to determine from the blurred lines of the composite picture." Professor J. Douglas Brown and his assistants have prepared an excellent study of labor banking in the United States. The analysis is not only impersonal but also impartial in its view of the various labor banks. Each bank is accorded a special historic résumé which should be of great value to the student. The study is fascinating and gives the uninitiated a clear and comprehensive view of the situation to date.

The purposes or motives for which labor banks were organized are reduced to five classes—business, protective, aggressive, coöperative and psychological. The chief incentive appears to have been self-preservation. During the post-war period and general business depression, certain banks took an antagonistic attitude toward labor and brought pressure on manufacturers with union employees. Organized labor took action to control their own funds and designate the channels through which these funds should flow.

The two most vital principles that labor bankers must follow are safety and service. The bank must be particularly safe because of the inherent financial position of many of its depositors, and it must give service because of the average depositor's lack of opportunity to obtain sound financial advice elsewhere. In no instance has the depositor in any labor bank suffered from a depletion of deposit funds by any failure. In the case of the Producers' and Consumers' Bank of Philadelphia, the depositors were saved by the assumption of deposit liabilities by the Mitten group. There have been casualties in the ranks of labor banking, but without loss of financial life to the depositor.

To measure success by growth of resources, returns to stockholders, or direct financial returns to the depositor may be misleading. This is especially true of labor banking, because of the number of unconnected banks with very different views and management. The dividend return in many cases is limited deliberately, usually to ten per centum. Stress is placed on service to the depositor as such, rather than as a means to increase business, profits and dividend returns.

Whereas the capitalistic bank can have no other aim than to make as much money as possible for its shareholders, the labor bank's first consideration must be to serve its customers.

Professor Brown mentions the various services to the wage-earner which should be the special function of labor banks, and describes the efforts made to fulfill them. All have encouraged him to place his financial problems before the bank executive. In general they have given him investment advice not colored by having anything on the shelf to sell. They have given aid to coöperative enterprises and made strategic loans to manufacturers. They led the way to increased interest to savings depositors; and even, in some cases, gave extra interest dividends to depositors. They have made remittances to relatives and friends of their customers in foreign countries having violent exchange fluctuations, by the simple expedient of shipping United States currency to the recipient. In the salient instance of Soviet Russia during the early years of the present régime, this required much organization.

Perhaps the most interesting, and certainly the most far-reaching of the special services rendered by labor banks is the personal or character installment loan. The Amalgamated Bank of New York was one of the first banks in the country to enter this field, making small loans to its customers and friends at rates far below those charged by industrial loaning agencies. As commercial banks throughout the country came to the belief that this type of loan could be profitably handled by banks, many received advice on the subject from the Amalgamated Bank, both through direct inquiry and through a committee of the American Bankers' Association. In a short time these banks have been recognized as the strongest agencies working against the loan shark evil.

Labor banking has had its black eyes as well as its bouquets. The early success of the Engineers' Bank in Cleveland gave promoters an excellent opportunity to foster new banks on a stock selling basis, with disastrous results in many cases. The very fact that labor banks are close to the wage-earner and have the incentive of service has proved to be a mixed blessing. It is hard to refuse the bank's money to a friend.

Professor Brown attributes some of the casualties among labor banks to the unfortunate use of the banks as a political weapon for the union's chief executives. He expresses no opinion as to whether close contact with trained bankers has strengthened the financial position of those unions whose banks have been successful. Surely this should be among the important secondary functions of labor banks. In closing Professor Brown says:

> Like all movements which pioneer new fields of social endeavor, labor banking has passed through a cycle of growth and decline. After ten years of experience, the elements of success and failure can be sifted and weighed. Labor's entrance into finance early caught the imagination of many students of social problems. The accomplishments of the successful labor banks have warranted the keen interest and enthusiasm they have aroused. As a permanent residual, their continued growth will permit further contributions to democratic banking. But it is the labor movement and its leaders who must consider gravely both the debits and the credits of the experiment. Without the most painstaking examination of the experiences of the past, a revival of the movement of the post-war years would be both dangerous and inexcusable.

JOHN G. ROLPH

The Cost of Living in Twelve Industrial Cities, by the National Industrial Conference Board. New York. 1928. 76 pp.

It is rarely the privilege of the statistician to solve his problem in an ideal manner. His solution usually must follow the line of his data and often he is forced to modify his problem to fit the solution. In no case is this more true than in the study of the cost of living, especially when it relates to a comparison of different communities or different periods of time. This study is not free from that limitation.

Broadly speaking, the comparative cost of living in different places may be studied from three distinct angles, as follows:

1. The cost of an identical mode of living, implying the consumption of an identical list of goods and services of equal quality and quantity, without regard to actual conditions of consumption in the different communities. This method has the merit of giving very definite results. But it is highly artificial, since consumption habits and consumption facilities are not the same in different places.
2. The actual average cost of living of a given economic class, irrespective of whether or not the mode of living or even the economic status of that class is identical in the different localities. Thus it is statistically feasible to compare the average living expenses of carpenters or plumbers in Chicago, Quebec, and Mexico City. This too would yield clear-cut results subject to definite interpretation.
3. The cost of maintaining life and comfort, calling for a study of the *necessary* expenditures rather than the actual expenditures. Unless confined to mere subsistence, this problem is least susceptible to accurate statistical treatment. The requirements above subsistence can be only arbitrarily fixed, and to do so with fairness for different localities is not an easy task.

The last approach is the one presumably adopted by the author of *The Cost of Living in Twelve Industrial Cities*. However, in reality the procedure followed in the study has elements of each of the three angles indicated above. In the case of food and clothing it was apparently found most convenient to compile composite costs of an identical weighted list of articles. To determine the cost of shelter a different method was pursued. Instead of pricing identical types of housing in each community it was deemed more desirable to measure the cost of "the prevailing form of housing in each locality, the type of shelter upon which the majority of wage earners' families must depend." The only common requirements laid down in the collection of housing costs were a "decent neighborhood," a "fair state of repair, cleanliness and sanitation," and "a bathroom for the exclusive use of the family." The principle underlying the compilation of the cost of fuel and light is again different. In this case the actual requirements, based on climate, heating facilities in the prevailing form of housing, availability of different fuels, and custom were taken into consideration. The cost of sundries was necessarily based on purely arbitrary figures and, with the exception of transportation and amusements, each city was given the same allowance.

The results and conclusions of the study should be viewed in the light of the mixed character of the method. In this light the concept "Cost of Living" appears blurred and indefinite. In the matter of food and clothing the cost of living is based on a standard uniform for all cities, but with respect to housing and fuel and light it is based upon custom or physical supply peculiar to each city.

According to the final figures, the annual "cost of living" for a standard family in New York City is only $31.51 higher than in Philadelphia. However, in New York the standard family is allowed four rooms (heated by stove), "in keeping with the general custom," while in Philadelphia the allowance is six rooms. Moreover, while most of the apartments available to wage earners' families in New York City are in old tenements with little light or air, in Philadelphia the "houses in the industrial workers' section are as a rule two stories high with three rooms to the floor . . . heated with hot-air furnaces" and "have at least a small yard in the rear."

Lest a wrong impression be gained with respect to housing conditions in New York City, it should be added that "the type of shelter upon which the majority of wage earners' families must depend" in Greater New York is not a four-room apartment in "fair state of repair, cleanliness and sanitation" with "a bathroom for the exclusive use of the family," in a "decent neighborhood," renting at the rate of $8.50 per room per month. In 1926 (the housing statistics for New York City in the report under review are for that year) the New York State Board of Housing found that more than 33 per cent of all the available suites in the City were in old law tenements. Very few of these had bathrooms and in only a small proportion of the other 67 per cent was the rental as low as $8.50 per room per month.

MAURICE LEVEN

The Dependent Aged in San Francisco, Prepared under the Heller Committee for Research in Social Economics of the University of California, in collaboration with the Coördination Committee of the San Francisco Community Chest. Berkeley: University of California Publications in Economics, Vol. 5, No. 1. 1928. xiv, 127 pp.

The problem of proper care for the aged is gradually attracting increased attention among social workers as well as those interested in social legislation. Both public and private investigations on the subject have been multiplying during the last few years. Students of the subject are, of course, familiar with the series of studies issued by the Pennsylvania Old Age Pension Commission (now defunct), by a State Commission in Massachusetts, and the recent report of the National Civic Federation which has created quite a sensation in the public press. The increasing proportion of persons over sixty-five in the population, partly due to a reduced birth-rate and partly to the somewhat increasing span of life, is emphasizing the problem not only as a public policy but also as a field of activity for social agencies. This study of the problem in San Francisco offers a good deal of corroborative evidence that the problem can't be neglected.

One of the severest criticisms of the report of the National Civic Federation was that it had entirely disregarded the aged in institutions. Its method in the general population was to obtain a fairly large sample of persons over 65 years of age and then determine their economic status. The San Francisco report deals entirely with the dependent aged, those already in institutions or receiving outdoor relief. The extent of the problem, social data about causes, the extent to

which the community meets the problem of old age relief and the various methods of meeting the problem, are all exhaustively handled in the report. It, therefore, deserves the most careful study of every case worker, particularly those who are connected with family agencies.

The results as summarized in the "Abstract of Findings" are significant. In 1925 there were in San Francisco 2,156 dependent aged, constituting some 6 per cent of the population over 60 years of age. Nearly 1,800 or about 83 per cent were receiving institutional care and 17 per cent were receiving out relief. The wider subject of old folks depending upon their children or relatives has not been touched in the report, though, of course, that must represent a very serious problem where the burden of supporting the aged substantially interferes with the standard of living of the younger generations. In a very interesting introduction, Miss Katherine C. Felton, one of the most prominent social workers in San Francisco, points out that private philanthropy in San Francisco never had sufficient money for relief, that such work as could be done is being concentrated perhaps properly upon the children because of greater constructive value, and that the care of the aged is being neglected, particularly as far as outdoor relief is concerned. "Outside of the Jewish group, no system of out relief for the aged poor in their own home has been developed in San Francisco." Without committing itself to any definite opinion on old age pensions, the report furnishes a very interesting estimate of probable cost of such a pension, the figures being somewhat between 4 and 6 million dollars.

As to the causes of old age dependency, while the report adds nothing new, it corroborates the general impressions of case workers. From the point of view of provision for old age, children are still an investment, albeit not always a secure one. Unmarried and childless persons predominate among the aged in San Francisco as elsewhere. A somewhat more debatable point receives a good deal of illumination, and that is the relation between aged dependency and immigration. This investigation arrives at the conclusion that there is no direct relationship, that the problem of old age dependency is independent of conditions of immigration, and that immigrants furnish no larger proportion of aged dependency than do native born. All in all, the report presents a very valuable contribution to our stock of knowledge on this problem which is bound to continue increasing as the proportion of the aged increases. There is perhaps very little constructive case work on psychiatric or any other lines that can be done for persons over 65 or 70 years of age. But the least society could do for them is to give them decent physical conditions of existence during their few declining years. The report shows that even though the San Francisco Relief Home for the Aged, a public institution, is of much higher grade than most institutions of this character, nevertheless, this type of care for the aged remains unsatisfactory to a great many of the old folks because of the psychologic injury involved.

I. M. Rubinow

Cincinnati, Ohio

Mathematics Preparatory to Statistics and Finance, by George N. Bauer. New York: The Macmillan Company. 1929. viii, 337 pp.

Mechanics of Accounting, by Leo A. Schmidt. New York: Prentice-Hall. 1929. xvii, 230 pp.

Mr. Bauer's book, to use his own words, is a "study of simpler mathematical methods and principles that occur frequently in elementary courses in these subjects." The volume contains nine chapters dealing with such subjects as Graphs and Charts, the Straight Line Law, the Law of the Parabola, Logarithms, Arithmetical and Geometrical Progression, the Exponential Law, the Power Law, Curve Fitting, and finally Permutations, Combinations, and Probability. A table of common logarithms, an index and twenty pages of answers to problems complete the book.

In chapter one the author explains clearly the principle of a line graph and after reading these pages the student will realize the many possibilities of this method of presentation.

Mr. Bauer draws frequently on the principles of analytic geometry in his text and once these principles have been understood the field of future application of graphic methods will be considerably enlarged.

In the discussion of the least square solution in the second chapter I believe that the student should have been referred to pages 241 and 242 where he will find a definition of what "least squares" really means. It seems important that this definition be brought to the attention of the reader at an early stage of his studies. In presenting mathematical problems it proves sometimes economical from a pedagogical point of view, to outline the goal in sharper contours sooner than logic dictates, even if mathematical proofs cannot be included at the time. Mr. Bauer has devoted considerable space of his book, realizing the importance of the subject, to the discussion of logarithms and offers numerous examples and questions relating to their application.

The writer believes that a bibliography of books on statistical methods would not have been out of place. The publishers have added to the appearance of the book by using clear type and line cuts to make the volume a desirable addition to a student's library.

In the preface to the *Mechanics of Accounting* Mr. Schmidt states:

> A departure from usual form is the greatly expanded use of simple "T" accounts. Formal ledger rulings are practically dispensed with; dates, posting references, and explanatory notations in ledger accounts are unnecessary in all but a few problems. The space required for each account is thus reduced so that it is possible to keep the whole ledger on one sheet of paper with like accounts in their natural groups. This schematic grouping of accounts on the face of the ledger is the greatest possible aid to students in visualizing the essential relationship between accounts and that, after all, is the real backbone of accounting.

This is the spirit in which the book is written and it forces the reader to think constantly in terms of the philosophy and mechanics of accounting and to train his judgment for the final solution of more and more complicated balance-sheet problems. Problems represent the major portion of the book and, used in connection with lectures given in the classroom, *Mechanics of Accounting* should prove to be a most valuable adjunct.

R. VON HUHN

Accounting by Machine Methods, by H. G. Schnackel and Henry C. Lang. New York: The Ronald Press Company. 1929. xii, 563 pp.

These authors have made a contribution to accounting literature. A book such as this could be constructed only by laboriously assembling and organizing many items of observation and experience, and from them formulating the generalizations and detecting the types which are significant. Professional consultants, business accountants and advanced students will find the book worth their attention.

The first three chapters provide a general basis for the later specific discussions. They contain an introductory statement of fundamentals, a comparative study of the characteristics of different types of accounting machines, and a description and analysis of accounting forms. These chapters are good but all too brief. Difficulties are encountered in comparing types of machines because certain characteristics are peculiar to *makes* rather than to the broad *types* selected for discussion. Scrupulous avoidance of manufacturers' names may, from the standpoint of the authors, be necessary but to many readers it will be disappointing.

The remaining fourteen chapters give detailed consideration to the procedures, forms, and use of machines in the major repetitive accounting operations. Bill and order writing, accounts receivable, installment sales, sales commission accounting, accounts payable, stock and material control, the payroll and its distribution, the general and subsidiary ledgers, and the payment of machine operators are the principal subjects discussed. There will be few accountants indeed who will not be able to glean from these pages more than one new idea for the improvement of accounting technique. Especially helpful for those entrusted with the revision of procedures are the check lists of points to be investigated.

Better books will certainly be written on machine accounting methods but they will have a larger store of material from which to draw. For a pioneer, or at least a near-pioneer effort this book is remarkable for its scope as well as its quality. The ambiguities and innocuous platitudes which occasionally mark the departures from plain facts can readily be overlooked.

THEODORE O. YNTEMA

Stanford University

Business Statistics, by Joseph Lyons Snider. New York: McGraw-Hill Book Company. 1929. 520 pp.

The progress that has been made during the past ten or fifteen years in the application of statistical measurement and analysis to business problems and in the training of students for such work is exemplified by this book by Dr. Snider. It is not another textbook on statistical methods, but is rather, as it is described on the title page, "a book of cases and materials," and is undoubtedly the best thing of the sort that has yet appeared. It is well designed as an aid to the training of students for practical statistical work in business organizations, which is evidently the primary aim of the author.

Dr. Snider defines the function of a university course in business statistics as the study of quantitative measurements of various factors which affect the success of the business man or the investor. His book is compiled with a view to presenting illustrative materials and methods of analysis of two of the principal factors that affect the success of the business man or the investor: first, the current condition and outlook in the particular industry; and, second, the current condition and outlook of business in general.

Three chapters out of a total of twenty-six deal with general matters of statistical procedure—the tests to be applied to statistical data before using them; methods of adjustment of data for seasonal variations and secular trend; and the making of index numbers. With these exceptions the earlier chapters of the book are devoted to the presentation of case studies of particular industries, and the later chapters to some of the principal data relating to the more general measurements of business, and to financial factors affecting business or investment operations, with a concluding chapter on business forecasting.

Among the materials included are studies of individual industries and more general measures of business and financial conditions made by the Harvard Economic Society, and sections contributed from published or unpublished studies of others who may be regarded as experts in their fields. A wide variety of commodities and industries is represented by the illustrative studies, including hides, automobiles, petroleum and gasoline, iron and steel, copper and tin, agriculture and specific agricultural products, cement, construction, and the railroad industry. The factors analyzed are production, consumption, stocks, and in many cases the outlook for prices or profits, or both.

The section of the book relating to more general business or financial conditions deals briefly with measures of the volume of manufactures, wholesale prices in general, cost of living, commodity inventories, retail trade, foreign trade, business profits, and national and regional indexes of general business activity, and includes also discussions of the Federal Reserve System, the money market, and security prices.

The volume indicates the wealth of material which has become available in this "statistical age" and the exceedingly practical manner of its application to present day business. Until a comparatively few years ago there were very few industries that recognized the need for the services of the statistician, or that were willing to contribute the facts of their individual businesses for the common welfare. The cases cited by Dr. Snider illustrate the tendency to replace "hunches" regarding production schedules and prices with quantitative measurement of the relevant factors, with the end in view of reducing mal-adjustments between production and consumption, and ending practices that in some cases are destructive to whole industries.

The book will be found useful by many engaged in practical statistical work as well as by those in the classroom.

H. V. Roelse

Profits in Insurance Stocks in America, by W. H. Woodward. New York: The Macmillan Company. 1928. 122 pp.

Investment Trusts in America, by M. H. Williams. New York: The Macmillan Company. 1928. 152 pp.

Profits in Insurance Stocks is a small volume prepared by the sales manager of one of the largest brokerage firms dealing in bank and insurance stocks, pointing out the advantages of a long term investment in the securities of insurance companies. Mr. Woodward points out their similarity to investment trusts. He cites the fact that they are under state supervision; that there is complete reporting of their earnings and financial position; that their investments are well diversified and that their management of funds as shown by results of the old established companies is good. The book contains a brief résumé by companies of the financial history of some of the important insurance companies, stressing results from investments. Mr. Woodward admits that it is not unusual for a company to lose on the underwriting part of the business.

There is no comparison made between the rise of insurance company securities and the securities of leading industrial companies during the last bull market, nor is there sufficient discussion of the relation of market price of the insurance security to the liquidation value. Securities of insurance companies from 1926 to 1929 sold on the average at about 1.65 times their liquidation value. Granted that there has been good management, it is a question whether the investor is not paying too great a premium for this service.

The volume on *Investment Trusts in America*, by Mr. M. H. Williams, discusses in some 90 pages, the general principles underlying the operation of investment trusts. Examples of various types of trusts, *i.e.*, general management, the fixed trusts and trusts operating in specific industries only are given. He emphasizes the management factor and the need for the investor to know that the management is not affiliated with other financial interests in such a way as to prejudice the management in a free selection of securities for the trust. The book contains appendices giving the portfolio of various investment trusts. A chart showing the experience of various investment trusts in 1927 prepared by Grover O'Neill and Company is also appended.

H. K. Herwitz

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H. K. Herwitz

NEW SERIES, NO. 169 A (VOL. XXV) MARCH, 1930
SUPPLEMENT

PROCEEDINGS OF THE AMERICAN STATISTICAL ASSOCIATION

Edited by FRANK ALEXANDER ROSS

CONTENTS

PROGRAM OF ANNUAL MEETING 1
CORPORATION ACCOUNTING DATA FROM THE STANDPOINT OF THE INVESTOR. By Lewis H. Haney 7
NEEDS OF INVESTORS WITH RESPECT TO CORPORATION STATISTICS. By Harold G. Parker 13
PROBLEMS IN THE UTILIZATION AND INTERPRETATION OF CORPORATION STATISTICS. By George P. Watkins 18
FEDERAL CORPORATION STATISTICS. By E. Dana Durand 23
DISCUSSION. By J. F. Ebersole 28
EVALUATION OF ECONOMIC FORECASTS. By Garfield V. Cox 31
APPRAISAL OF ECONOMIC FORECASTS. By S. L. Andrew and H. M. Flinn 36
DISCUSSION:
I. By Donald Tucker 41
II. By Arthur W. Marget 45
III. By J. G. Thompson 47
THE FOREIGN TRADE OF 1929. By E. Dana Durand 51
PRODUCTION AND PRICES IN 1929. By Joseph L. Snider 56
THE 1929 AGRICULTURAL SEASON. By A. B. Genung 58
THE BUILDING SITUATION. By Thomas S. Holden 64
CREDIT DEVELOPMENTS IN 1929. By E. A. Goldenweiser 69
A HASTY ESTIMATE OF THE NATIONAL INCOME IN 1929. By Willford I. King 73
SECURITY PRICES. By James F. Hughes 76
CORPORATE EARNINGS AND STOCK PRICES. By Robert C. Effinger 80
THE RÔLE OF INVESTMENT COMPANIES. By Leland Rex Robinson 83
BROKERS' LOANS AND THE PYRAMIDING OF CREDIT. By Carl Snyder 88
THE STOCK MARKET PANIC IN 1929. By Irving Fisher 93
FORECASTS FOR 1930. By Paul Clay 97
MEASURING INVESTMENT VALUES. By Malcolm C. Rorty 100
CERTAIN ASPECTS OF THE INTERPRETATION OF PRICE-EARNINGS RATIOS. By Norris O. Johnson and John T. Shirer 106
DISCUSSION. By Lionel D. Edie 110
THE CENSUS OF POPULATION. By Leon E. Truesdell 113
UNEMPLOYMENT AS A CENSUS PROBLEM. By Charles E. Persons 117
THE CENSUS OF MANUFACTURES. By LeVerne Beales 121

Contents

THE CENSUS OF DISTRIBUTION. By Robert J. McFall 125

THE CENSUS OF AGRICULTURE. By William L. Austin 130

SCALES FOR FAMILY MEASUREMENT. By Faith M. Williams 135

SOME DEVELOPMENTS IN THE TECHNIQUES OF STUDYING CONSUMER DEMAND. By Warren C. Waite 140

GENERALIZED MULTIPLE CORRELATION ANALYSIS OF ECONOMIC STATISTICAL SERIES. By Max Sasuly 146

STATISTICAL ANALYSIS IN FOOD COMPOSITION STUDIES. By Charlotte Chatfield 153

AGRICULTURE IN THE POST-WAR DECADE. By Louis H. Bean 155

AMERICAN LABOR SINCE 1920. By Leo Wolman 158

RECENT CHANGES IN OUR WHOLESALE PRICE LEVEL. By Morris A. Copeland 164

EUROPE TEN YEARS AFTER THE WAR. By Marcus Nadler 170

DISCUSSION. By Robert B. Warren 174

MINUTES OF THE ANNUAL BUSINESS MEETING 177

REPORTS OF

SECRETARY 180

TREASURER 181

AUDITING COMMITTEE 184

EDITOR 184

COMMITTEE ON GOVERNMENTAL LABOR STATISTICS 185

JOINT ADVISORY COMMITTEE TO THE DIRECTOR OF THE CENSUS 192

COMMITTEE ON INSTITUTIONAL STATISTICS 194

COMMITTEE ON THE ENCYCLOPAEDIA OF THE SOCIAL SCIENCES 195

COMMITTEE ON SOCIAL STATISTICS 196

COMMITTEES FOR 1930 197

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NINETY-FIRST ANNUAL MEETING

OF THE AMERICAN STATISTICAL ASSOCIATION
HELD AT HOTEL WASHINGTON, WASHINGTON, D. C.

FRIDAY, DECEMBER 27, TO MONDAY, DECEMBER 30, 1929

PROGRAM

FRIDAY, DECEMBER 27

10:00 A. M.

Topic:
Business Statistics

Chairman:
Francis Walker, Vice-President, American Statistical Association

Papers:
Corporation Accounting Data from the Standpoint of the Investor
Lewis H. Haney, New York University
Needs of Investors with Respect to Corporation Statistics
Harold G. Parker, Standard Statistics Company
Problems in the Utilization and Interpretation of Corporation Statistics
George P. Watkins, Federal Trade Commission
Federal Corporation Statistics
E. Dana Durand, Statistical Assistant to the Secretary of Commerce

Discussion:
Edmund E. Lincoln, International Telephone and Telegraph Company [1]
J. F. Ebersole, United States Treasury Department

2:30 P. M.

Topic:
Appraisal of Economic Forecasts

Chairman:
Wesley C. Mitchell, Columbia University

Papers:
Garfield V. Cox, University of Chicago
Seymour L. Andrew and Harold M. Flinn, American Telephone and Telegraph Company

Discussion:
Donald Tucker, Massachusetts Institute of Technology
Arthur W. Marget, University of Minnesota
J. G. Thompson, Simonds Saw and Steel Company

8:00 P. M.

Topic:
Business in 1929

Chairman:
Edmund Platt, Federal Reserve Board

[1] No manuscript submitted.

Papers:

The Foreign Trade of 1929
E. Dana Durand, Statistical Assistant to the Secretary of Commerce

Production and Prices in 1929
Joseph L. Snider, Harvard Graduate School of Business

The 1929 Agricultural Season
A. B. Genung, United States Department of Agriculture

The Building Situation
Thomas S. Holden, F. W. Dodge Corporation

Credit Developments in 1929
Emanuel A. Goldenweiser, Federal Reserve Board

A Hasty Estimate of the National Income in 1929
Willford I. King, Secretary, American Statistical Association

SATURDAY, DECEMBER 28

9:00 A. M.

Business Meeting

10:00 A. M. *Section I*

Joint Meeting with the American Sociological Society [1]

Topic:

Progress in the Application of Statistical Methods to Social and Sociological Problems

Chairman:

Edwin B. Wilson, President, American Statistical Association

Papers:

The Family and Marriage
William F. Ogburn, University of Chicago

Dependency
Ralph G. Hurlin, Russell Sage Foundation

Crime and Police Administration
C. E. Gehlke, Western Reserve University

Health and Medical Care
Hugh S. Carter, University of Pennsylvania and Committee on the Cost of Medical Care

10:00 A. M. *Section II*

Topic:

Security Markets in 1929

Chairman:

David Friday, A. G. Becker & Company

Papers:

Security Prices
James F. Hughes, Otis & Company

Corporate Earnings and Stock Prices
Robert C. Effinger, Irving Trust Company

The Rôle of Investment Companies in the Security Markets of 1929
Leland Rex Robinson, Second International Securities Corporation

[1] All papers of this meeting will appear early in 1930, in *Statistics in Social Studies*, edited by Stuart A. Rice, Philadelphia, University of Pennsylvania Press.

Brokers' Loans and the Pyramiding of Credit
Carl Snyder, Federal Reserve Bank, New York
The Stock Market Panic in 1929
Irving Fisher, Yale University

1:00 P. M. *Section I*

Luncheon

Topic:
Forecasts for 1930

Chairman:
William M. Steuart, Director of the Census

Papers:
Paul Clay, United States Shares Corporation
David Friday, A. G. Becker & Company [1]
Leonard P. Ayres, Cleveland Trust Company [1]

1:00 P. M. *Section II*

Joint Luncheon Meeting with the American Sociological Society [2]

Topic:
Progress in the Application of Statistical Methods to Social and Sociological Problems

Chairman:
Robert E. Chaddock, Columbia University

Paper:
Prohibition: Enforcement and Social Effects
John C. Gebhart, American Association Against the Prohibition Amendment

Discussion:
Irving Fisher, Yale University
Herman Feldman, Dartmouth College

2:30 P. M. *Section I*

Topic:
Evaluation of Securities

Chairman:
Carl Snyder, Federal Reserve Bank of New York

Papers:
Measuring Investment Values
Malcolm C. Rorty, International Telephone and Telegraph Company
Certain Aspects of the Interpretation of Price-Earnings Ratios
Norris O. Johnson and John T. Shirer, Investment Research Bureau, Auburn, New York

Discussion:
Warren M. Persons, Goldman, Sachs & Company [1]
Lionel D. Edie, Investment Research Corporation

2:30 P. M. *Section II*

Joint Meeting with the American Economic Association and American Farm Economic Association [3]

[1] No manuscript submitted.
[2] All papers of this meeting will appear early in 1930, in *Statistics in Social Studies*, edited by Stuart A. Rice, Philadelphia, University of Pennsylvania Press.
[3] Published in *Journal of Farm Economics*, January, 1930, Vol. XII, No. 1.

Topic:
Price Analysis and Price Forecasting

Chairman:
Henry E. Erdman, President, American Farm Economic Association

Papers:
A Program for the Improvement and Elaboration of Data Needed for Commodity Price Forecasting
Oscar C. Stine, United States Bureau of Agricultural Economics
An Evaluation of Methods Used in Commodity Price Forecasting
Elmer J. Working, United States Bureau of Agricultural Economics
The Use of Statistical Methods in Commercial Forecasting
Donald Cowan, Swift and Company

Discussion:
Arthur W. Marget, University of Minnesota
Elizabeth Waterman, Harvard Economic Committee
Charles O. Hardy, Institute of Economics
Hilding E. Anderson, Case, Pomeroy & Company

8:00 P. M. Joint Meeting with the American Sociological Society and the American Economic Association

Chairman:
Hon. Ray Lyman Wilbur, M.D., Secretary of the Interior

Presidential Addresses:
Folkways of a Scientific Sociology
William F. Ogburn, American Sociological Society [1]
Mathematics and Statistics
Edwin B. Wilson, American Statistical Association [2]
Historical Records
Edwin F. Gay, American Economic Association [3]

Smoker

MONDAY, DECEMBER 30

9:00 A. M.

Business Meeting

10:00 A. M. *Section I*

Topic:
Plans and Problems of the United States Census

Chairman:
Joseph A. Hill, Assistant Director of the Census

Papers:
Organization of the Census
William M. Steuart, Director of the Census [4]
The Census of Population
Leon E. Truesdell, Chief Statistician for Population, Bureau of the Census

[1] To appear in the Publications of the American Sociological Society, Vol. XXIV, *Studies in Quantitative Sociology*, p. 1.
[2] Published in this JOURNAL, March, 1930, Vol. XXV, p. 1.
[3] Published in the *American Economic Review*, March, 1930, Vol. XX, p. 1.
[4] No manuscript submitted.

Unemployment as a Census Problem
Charles E. Persons, Bureau of the Census
The Census of Manufactures
LeVerne Beales, Chief Statistician for Manufactures, Bureau of the Census
The Census of Distribution
Robert J. McFall, Chief Statistician for Distribution, Bureau of the Census
The Census of Agriculture
William L. Austin, Chief Statistician for Agriculture, Bureau of the Census

10:00 A. M. *Section II*

Round Table Meetings on Application of Statistical Methods in Various Fields

A. Joint Meeting with the American Sociological Society [1]

Topic:
Progress in the Application of Statistical Methods to Social and Sociological Problems

Chairman:
Ralph G. Hurlin, Vice-President, American Statistical Association

Papers:
Personality and Mental Adjustment
Clifford Kirkpatrick, University of Pennsylvania
Social Attitudes and Public Opinion
Stuart A. Rice, University of Pennsylvania

B. Economics of Consumption

Chairman:
Hildegarde Kneeland, United States Bureau of Home Economics

Papers:
Analysis of Data on Family Expenditures
William F. Ogburn, University of Chicago [2]
Scales for Family Measurement
Faith M. Williams, United States Bureau of Home Economics
Some Developments in the Techniques of Studying Consumer Demand
Warren C. Waite, United States Bureau of Agricultural Economics
Generalized Multiple Correlation Analysis of Economic Statistical Series
Max Sasuly, Institute of Economics

C. Biology

Chairman:
Halbert L. Dunn, Mayo Clinic

Papers:
Applications of Statistical Method to Physiology and Medicine
Halbert L. Dunn, Mayo Clinic [2]
Applications in Agronomy
F. D. Richey, Bureau of Plant Industry [2]

[1] All papers of this meeting will appear early in 1930, in *Statistics in Social Studies*, edited by Stuart A. Rice, Philadelphia, University of Pennsylvania Press.
[2] No manuscript submitted. [3] Publication planned elsewhere.

Statistical Analysis in Food Composition Studies
Charlotte E. Chatfield, Bureau of Home Economics
Some Difficulties with Averages in Summarizing the Results of Experiments
C. P. Hartley, Bureau of Plant Industry [1]

2:30 P. M. *Section I*

Topic:
A Decade After the War

Chairman:
Mordecai Ezekiel, Vice-President, American Statistical Association

Papers:
Agriculture in the Post-War Decade
Louis H. Bean, Bureau of Agricultural Economics
American Labor since 1920
Leo Wolman, American Federation of Labor
Recent Changes in Our Wholesale Price Level
Morris A. Copeland, Cornell University
Money Market
Winfield W. Riefler, Federal Reserve Board [2]
Europe Ten Years After the War
Marcus Nadler, New York University

Discussion:
Robert B. Warren, Case, Pomeroy & Company

2:30 P. M. *Section II*
Joint Meeting with the American Sociological Society [3]

Topic:
Population Outlook for the United States

Chairman:
Robert E. Chaddock, Columbia University

Papers:
Present Outlook for Population Increase
Louis I. Dublin and Alfred J. Lotka, Metropolitan Life Insurance Company
Does Advancing Civilization Involve a Decline in Natural Fertility?
Frank H. Hankins, Smith College
Size of Family and Birth-Order of the Mentally Diseased
Neil A. Dayton, Massachusetts Department of Mental Diseases
Agricultural Significance of the Declining Birth-Rate
Oliver E. Baker, Bureau of Agricultural Economics

Discussion:
Warren S. Thompson, Scripps Institution, Miami University

[1] Publication planned elsewhere. [2] No manuscript submitted.
[3] To appear in the Publications of the American Sociological Society, Vol. XXIV, *Studies in Quantitative Sociology*.

CORPORATION ACCOUNTING DATA FROM THE STANDPOINT OF THE INVESTOR

By Lewis H. Haney

One of the crying needs of the hour is better corporation accounting data, *i. e.*, pecuniary statistics derived from books of account. We can dismiss the development of such statistics by saying that it has been painfully slow.

As statisticians, we need more and better data concerning revenues and expenses. Various intangibles and time series can be measured and compared only in dollars. As business analysts and forecasters, we need to know much more about "sales," and "turnover" of accounts receivable, etc. As economists, we badly want more data showing dollar performance, variations in net earnings, movements of profits in the business cycle, etc. As business men, we could get valuable lessons from standard operating ratios. As investors—well, more in a moment.

I would especially stress various important "turnover" figures and "operating ratios," and urge that the Department of Commerce compile those which are now available, for publication in the *Survey of Current Business*.

It is the original and primary purpose of accounts to show the proprietor the true state of his business, including the property used. We might, therefore, infer that the interests of the investor at least would be well served.

Not a few of our great companies do present good statements, reasonably detailed and frequent. The fact that Steel, General Motors, and Standard Gas and Electric can do this, is a *prima facie* reason for believing others can do likewise.

But any business analyst will almost immediately pick out certain standard weaknesses in the published corporation accounting data, which prevent him from knowing what are the investments or the true earnings of many of our great corporations.

First, corporation accounting statements lack detail, standardization, and constancy of form. Many large companies present so little detail that one must conclude that the intent is to conceal the true situation. (The pictures of various plants help but little!) The same conclusion is justified by rather frequent changes in form which make continuity of analysis impossible.

A distinct and important shortcoming lies in the lack of frequency

of accounting statements. Some corporations (*e. g.* sugar producers) insist that quarterly data are misleading, on the ground that a large part of their profits are made in one or another quarter during the year. It seems to me that this objection is specious, and particularly so in the present state of our enlightenment as to seasonal variations.

Aside from amount of detail, standardization, continuity, and frequency, the outstanding points are the handling of *surplus reserves*, of *inter-company accounts*, of the *valuation of assets* used in the business, and of the *distinction between capital and revenue charges*.

(1) Sometimes reserves are set up which are not justified, such as contingency reserves and sinking-fund reserves. Even as to reserves which are defensible, the amounts charged are apparently too often determined without reference to the interests of stockholders or to established accounting principles, thus creating secret reserves. The whole method of treatment is often arbitrary, and depends largely upon the desire of the management to conceal or to pad "reported earnings." (And to make matters worse we frequently are not told what reserves, if any, there are.)

(2) As to inter-company relations, we all know that it is quite impossible in important cases to ascertain the equities of one company in another company. Earnings, as reported, frequently over long periods of time are made to include only the dividends received on the stocks of subsidiaries, which may represent only a small part of the earnings, though, of course, the thing may work the other way. "Other income" is sometimes an important blind spot. The holding company, with its "minority interest" item, is a very sore spot.

(3) And are the charges for maintenance made by any company in any particular period reasonable? Or do they include expenditures which really represent additions and betterments?

I should say that to be very specific, the two most important points are the charges or *reserves for depreciation and depletion*, and the *valuation of assets, both fixed and current.* If we could know what the approximate true value of the property is (including the inventories) and the equity of the common stock therein, and if we could know that the depreciation account represents an honest and skillful attempt to maintain the property (and no more), we would perhaps be able to solve 50 per cent of the troubles that now confront the investor or the statistician who deals with accounting data.

I will merely sum up by saying that data should be available to allow us to know the true

1. Net sales during a given period
2. Inventories

3. Net earnings
4. Current position
   (a) Working capital
   (b) Current ratio
   (c) Cash
5. Total capital employed
6. Net worth

Then we could compute the vital operating and financial ratios: (a) turnover of total capital employed, (b) turnover of fixed capital, (c) turnover of net worth, (d) turnover of inventories, (e) turnover of accounts receivable (collection period), (f) profits on sales (g) profits on investment.

Every one of these items is feasible and valuable. Not a one can be omitted without omitting an important basis for judging either the position of a given company or the position of an industry or industries in groups.

In looking over this list of items, I note that the chief points at which difficulty is met in compiling them from currently available data appear in the matter of *intangibles* (as affecting net worth), *surplus reserves, depreciation charges, inventories,* and *sales.* Of course, too, there is always the problem of determining what are truly current assets and current liabilities. As statisticians, we must not forget that one of the fundamental items is a true statement of *net sales* or true gross revenues, for the period. It is surprising how many corporations do not give this basic information.

Take the 1928 annual report of Westinghouse Electrical and Manufacturing Company, for example. In lieu of any statement of expenses, it gives one item "cost of sales," which is described as follows: "Manufacturing Cost, including Depreciation of Property and Plant; all Distribution, Administration and General Expenses; and Provisions for Taxes and Reserves"!

We are told in the text that there were some additions to plant and equipment, and that "adequate" depreciation charges were made. But the only figure presented is a lump value of fixed assets which is somewhat reduced from the figure of the preceding year.

The report shows great reserve—but no reserves!

The report does not even go so far as to show any "provision for Federal Income Tax." (Possibly the omission is made because snooping analysts have shown a tendency to estimate earnings from Federal taxes, rather than accept the reported earnings!) About the only way to guess at the true earnings of American Can and General Electric is to take their Federal tax provisions.

What can the poor investor do? First, he cannot find out where a company's receipts come from, so as to distribute them as earnings from operation, sales of assets, sales of stock, borrowings, and other income.

Then he cannot find out where the money goes, for, in addition to dividends, there are unknown additions to (or are they subtractions from?) assets, both fixed and current.

I challenge anyone here to tell me what General Electric earns. What is the true investment of National Biscuit? How are the heavy maintenance charges of American Telephone and Telegraph to be justified? No one knows. No one can find out.

The great excesses in the stock market during the past year have been most notable in the case of the so-called good companies whose stocks command high prices. No one knows what they are worth, and this makes it possible to entertain exaggerated hopes. If you do not know what General Electric is worth, may it not be worth 400? This, I think, was an important factor in the inflation that developed. Then, on the crash, panic was intensified, as so few could know what their stocks are really worth.

Of one thing I am sure, namely that an outgrowth of the widespread interest in securities, partly fostered by our great corporations themselves (in their desire to produce an identity of interest between themselves and their laborers, and consumers—to say nothing of the voter) is sooner or later going to bring powerful pressure upon them to publish more adequate information. (Maybe customer ownership will prove to be a Trojan horse.) If we are to become a nation of stockholders, we are going to insist upon the rights of owners. We want to invest, but investment without knowledge is not investment; it is speculation.

Not only do investors want the information that any prudent investor must have, but we may well ask by what right any of our great interstate utility companies refuse to publish the most significant facts concerning their operations.

And if we are not to enforce our anti-trust laws (*e. g.*, copper and oil) can we not at least expect a decent amount of information about the members of the various "institutes" which are "stabilizing" and "conserving" our industries?

We prate about the stock market being a great machine for directing the flow of investment funds. But if investors cannot know the values of their investments, the working of this machinery becomes more or less of a farce. One of the surest ways to protect the stock market from attacks, both inside and outside of Congress, is to make it possible for the buyers and sellers of stocks to act intelligently. At present, it is

like a grain or cotton exchange trying to operate without standard grades and units of grain and cotton!

But we might as well recognize that these forces alone will never be strong enough to achieve the desired results. Corporation managements will always at times fall under the influence of short-time, selfish motives. They are but human. The Stock Exchange is itself a business organization competing with other stock exchanges. We must, therefore, contemplate the feasibility of adopting some legal requirements.

Railway accounting, as compared with industrial accounting, is immeasurably better, thanks to Federal regulation (and incidentally railway stocks have not been subjected to the excesses found in other groups). To some extent, interstate utilities, and the utilities in certain states are subject to desirable accounting regulation, and the same may be said of national banks.

But it is pretty clear that state regulation cannot be counted upon. There is always Delaware!

The first thought of many people is that Stock Exchange listing requirements furnish the best means of attaining this end. We must remember, however, that the stock exchanges are business organizations, and that their members are very sensitive as to the adoption of measures which will deter companies from listing their securities. It is a fact that if one stock exchange adopts too strict an attitude, companies will list their stocks on another exchange. If left to themselves, therefore, I am doubtful if much further progress is to be expected in this quarter, and am doubtful as to the feasibility of attempting to regulate the listing requirements of exchanges. But some of the recommendations of the Hughes Commission still remain without effect (*e. g.*, as to frequency of statements and responsibility of those making them for their accuracy), and these should be carried out.

Also it appears that several companies have listed stock in very recent years without disclosing the actual depreciation charges made (Commercial Solvents, Columbia Gas and Electric, American Brake Shoe and Foundry, Eastman Kodak, Dupont). It can be fairly charged that the New York Stock Exchange discriminates, as American Can and Standard of New Jersey report annually; Continental Can and Sinclair Oil, quarterly. If such companies as United States Steel, General Motors, Studebaker, and Timken Roller Bearing can report quarterly and show depreciation, why cannot American Brake Shoe and Eastman Kodak?

The conclusion is, therefore, Federal regulation. We need a sort of national pure accounting law, not for the purpose of penalizing pro-

moters, but for abolishing the ignorant stockholder. For this, it seems to me the basis may be found in the Interstate Commerce principle. Within wide limits, accounts are a matter of private business policy—depreciation, good-will, inventory values, etc. But when a corporation appeals to the interstate public for funds, does it not become affected with an interstate public interest? Should it not be required to furnish information sufficiently detailed, accurate, uniform, and frequent to allow an intelligent person with reasonable diligence to determine the probable worth of the stock?

If it were provided that no corporation, or other business concern, which does any business in Interstate Commerce (or, perhaps, which sells any stock in Interstate Commerce) could offer stock to the public unless it presents certain accounting data computed in standard form at quarterly intervals, I think it would be well. And the corporation officers and the investment banks which sponsor their issues must be held responsible for the accuracy of the data required.

Probably the Federal Trade Commission should be the organization to entrust with carrying out any such regulation, and the provision should be in the nature of an amendment to the Federal Trade Commission Act. In my opinion the present act (section 6) probably does not give the Commission power to regulate corporation accounting methods or to procure correct accounting data for the public.

As the most practical immediate step, I suggest that the Federal Trade Commission (or a special commission) be authorized at once and directed to make an analysis of the information given by corporations to stockholders, for the purpose of reporting what the situation is, what standard statements should be issued by different industries, and the best method of enforcing reasonable publication to stockholders of the earnings and assets of their companies.

To this end, I suggest that the American Institute of Accountants, the American Society of Certified Public Accountants, the Investment Bankers Association of America, the American Statistical Association, and the American Economic Association, unite in petitioning Congress to take this action.

NEEDS OF INVESTORS WITH RESPECT TO CORPORATION STATISTICS

By Harold G. Parker

Investors are again beginning to realize the value of reliable data, and it is to the statistician that they are turning for this information. Therefore, the needs of the investors can be said to be also the needs of the statisticians or analysts.

The only source of dependable information on the activities of a corporation is the corporation itself, through reports and statements issued. An extensive examination of these reports over a period of years has shown that, in practically all instances, they are woefully lacking in uniformity, explanation and detail. The only exceptions as groups are the railroads and public utility operating companies, whose reports are made in the form laid down by legislative bodies.

The primary function of a corporation report should be to give data sufficient to enable security holders to decide whether the securities owned should be held or sold. The old argument that detailed and complete reports would be used by competitors has been disproved. Yet, many of our best companies adhere to this belief. One reason for this attitude is that some of these companies were started as private concerns and the founders of the company are still in control. They feel that they, and not the stockholders, own the company.

The crying need of all security analysts and investors is for uniformity of statements of companies engaged in the same or similar lines of business, and that these statements be given in much more detail. How is it possible to judge the efficiency of the management of any concern unless we can obtain direct comparison with other companies in the same industry? How can we decide between two securities in different lines of endeavor unless we can assemble sufficient data on these companies and their respective industries?

Let us go over some of the major items in the income account and see how much information is ordinarily available or given to the investor, and at the same time see what data should be furnished to enable him to make an enlightened decision.

I believe that nearly everyone will agree that in any business perhaps the most easily understood figure is that of "gross revenue" or "gross sales." In many cases, unless a long term record of gross is available, it is impossible to determine whether the company is growing or is decadent. This figure is usually available for utilities, railroads and

retail organizations, but our best estimates of the balance of the industries are that this figure is lacking in 70 per cent of the reports.

In order that we may properly understand and make comparison of one organization with another in a similar line of business, we should be furnished with an item under the heading of "operating expenses," or, in the case of a selling organization, "cost of sales." This latter item should also be divided between "cost of production" and "general selling and administration expenses." The ratio between "gross revenue" and "operating expenses" over a period of years is a very significant one. Detailed information as to cost of production makes it possible to explain the variations in this ratio, yet in only 10 per cent of industrials do we receive these figures.

"Expenditures for maintenance, etc.," should be another separate item. With the exception of utilities and rails, which are required to report this item, the leading steel companies are practically the only group from which definite figures can be obtained as to the amount expended on repairs. It seems hardly necessary to point out why such an item is of importance to the investor in determining the probable physical condition of the properties at any one time.

Nearly all companies report some form of "other income," and in many instances this item represents a larger proportion of "net income" than would appear possible from an examination of the balance sheet. Under this head are lumped all profits other than those from operations, such as bank interest, dividends on securities owned, profits on sale of any current assets (and sometimes fixed assets) and other non-recurring income. If these figures are not given in detail the investor has no possible way of judging the source, or what proportion of the recorded total income was of such a special nature that it could be counted upon in calculating the possibilities of the corporation for the future.

So much has been said about abuses in the handling of the items "depreciation," "depletion," "obsolescence" and "reserves" that we hesitate to comment upon them here. You probably are all familiar with the old-fashioned practice of adjusting depreciation and other reserves to profits, in spite of the fact that they have nothing to do with each other.

Within the last few years "contingent reserves" have been found to be a convenient method of adjusting profits to suit the needs of the management. It is only necessary to report a certain amount of net earnings and then set aside a contingency reserve from surplus to lead a careless investor to believe that a company which is losing money is really showing profits. In most cases, this contingency reserve

amounts to a write-down that should have been shown before "net income." Or, perhaps the following year, the corporation finds this contingency reserve a desirable place to charge a certain proportion of current expenses. The result is that the succeeding year also shows, if one inspects only the net income, a very satisfactory report. Again, after receiving this report, the directors set aside a further sum from surplus, replacing the amount drawn upon in that year from its contingency reserves.

As this fantastic method was strictly in accordance with accounting practice, it was impossible for an organization such as Standard Statistics Company to do more than point out the method used in arriving at such "net income."

Many reports contain items under the general heading "other deductions." On examination these are found to include losses on sales of assets (either fixed or current), and any other deductions which could be classed as charges against the business for a given year, such as reserve for probable losses on inventories. We believe the investor is entitled to full details of items of this character, as any one of them may give a valuable clue to the ability of the corporation's management.

We have listed above several items which, in our estimation, should be given in detail with regard to every corporation. In addition to these, we believe that the investor is entitled to the fullest information on any surplus debits or credits, with explanations and reasons for each item, as well as any changes in the balance sheet or change in general policy.

To sum up in our rather loose percentage basis as outlined previously, gross revenue is not available in about 70 per cent of the cases other than utilities, rails and retail organizations, while operating expense detail is lacking in 90 per cent of the reports. Only 2 per cent of the companies give us a clue to maintenance expenditures, and 95 per cent of our corporations give us no detail as to "other income." Information as to "depreciation," "depletion," "obsolescence" and "reserves" is inadequate in about 50 per cent of the reports. The "federal tax" item is lumped with "other expenses" or "other taxes" in nearly 50 per cent of the reports. "Other deductions" is given in adequate detail by only about 25 per cent of the corporations with which we deal. The above statement proves, we believe, that the real need of the investor today is for figures already available but not made public.

Unfortunately, as we said before, many of the worst offenders from our standpoint are among our best-known corporations. Perhaps it

is well to state here what is meant by "offenders." Some of our leading corporations of the ultra-conservative type set aside greater reserves than are necessary and fail to report consolidated earnings. In other words, they do not tell their stockholders all about their properties. The stockholder may find his stock selling at a certain price-earnings ratio which compares unfavorably with that of another corporation with radically different accounting practices. He may well feel that he should either dispose of his securities, because they are selling out of line, or perhaps switch into the stock of the other company. How is he going to know how the two companies compare?

The growing popularity of stock dividends must be commented upon. We believe that stock dividends are much misunderstood by the average investor. In the simplest form, a stock dividend is this: Suppose you own 20,000 shares of a certain company which represent a 10 per cent interest. This company declares a 5 per cent stock dividend. What is the result? Are you any better off, except possibly in the matter of the increased marketability of the stock? No, the only change is that your 10 per cent interest is represented by 21,000 shares instead of the original 20,000 shares. If you are so foolish as to sell your so-called dividend, you are left with 20,000 shares which now only represent a 9½ per cent interest in the company. Therefore, you have sold part of your capital. Yet we have recently seen one of the great ruling bodies in our financial world give permission to investment trusts and holding companies to treat such items as income. And we also have seen advertisements drawing the attention of the investing public to the attractive *yield* obtainable through investment in securities *paying only stock dividends*. Concerted action should be taken by statisticians to educate investors by pointing out the fallacies involved in this situation.

The trend toward greater and larger companies in the last few years has seen the formation and expansion of large holding companies, chiefly in the utility field. Through purchasing control of the voting stocks of operating companies, some of these holding companies show assets of nearly a billion dollars. The necessity of financing these acquisitions has resulted in the formation of sub-holding companies and a great out-pouring of securities on the public. A complete analysis of the accounts of any of these holding companies is impossible. The consolidated income account and balance sheet make a fine showing, but unfortunately all inter-company items are eliminated. It is only when we go beyond this consolidated statement that we find a true picture of what is going on. Looking at the individual statements of the operating companies, we find that the income accounts only go

as far as "available for income," and sometimes this figure is shown before depreciation. This is done on the supposition that inasmuch as the common stock is fully owned it is nobody's business. But don't you agree that the bondholders, and the preferred stockholders, are entitled to know how much of their equity in earnings has been retained in the company, especially when the balance sheet shows a decline, or at the best a small increase in surplus? Also, aren't they entitled to know just what amount was paid to the holding company for "management and engineering fees," or what premium was paid for additional financing which was rendered necessary when the holding company declared as dividends to itself the entire earnings over a period of years? That these practices have prevailed is not a guess on our part, for we have actually traced them through the reports made by the holding company in conjunction with reports made by the operating companies to Public Service Commissions. We have also come across instances where all, or a part of a subsidiary operating company, has been transferred from one sub-holding company to another, with the result that both of the sub-holding companies appear to have benefited. These practices undoubtedly could be remedied by statisticians demanding fuller data from the holding companies, and thus being placed in a position better to enlighten the investor.

There are many other needs of the investor which cannot be given in detail here, but I believe that a fine beginning will be made when our corporations decide to issue more comprehensive reports. The oil industry, working through the Petroleum Institute, expects to have about 60 per cent of the major companies follow a uniform style in reporting 1929 earnings.

The Certified Public Accountants convention last summer discussed in a very serious way the question of standardized reports to stockholders. While progress is slow, I am glad to say that the trend is toward fuller and more satisfactory reports and that among the large corporations a few more converts are made each year.

PROBLEMS IN THE UTILIZATION AND INTERPRETATION OF CORPORATION STATISTICS

By George P. Watkins

The investor wants a more fundamental answer to the question what a stock is worth than the statement that it is worth what it will sell for. It is true he wants at the same time an easy "rule of thumb" basis for judging values. The familiar price-earnings ratio is a sort of answer to this question. But the simple comparison of current earnings with the current price is not sufficient. If the price-earnings ratio so taken signified much, that would be because of the stability of net earnings and of their availablity, as they are computed by the accountants of the corporation in question, for the payment of dividends. This proposition suggests numerous qualifications and questions as to the significance of the ratio.

Data of price-earnings ratios published in the Standard Statistics series of Net Earnings Bulletins have been tabulated as of August 23 and as of November 22, 1929. Only corporations with entries for both dates are included in the comparison here made. The price end of the ratio is as of the date given. The earnings end is for the year 1928. Since the same corporations appear in the two months, any variations in the ratios are due to the price end.

A comparative tabular statement of certain figures descriptive of these two lists of ratios is as follows:

	August	*November*
Number of ratios included	631	631
Maximum ratio	55	34
Minimum ratio	3	1
Mode	12	9
Median	14	10
Arithmetical average	16	11

It should be noted that the tabulation and computation regards only full units so that the value entered may be read as units and a fraction (approximately one-half). Two ratios reported in November but not in August much exceed the maximum ratio tabulated for the latter month.

A price-earnings ratio of as much as 40, or even of as much as 20, is clearly not the result of the capitalization of a net that is a constant quantity from year to year. Consideration—even rather formal consideration—of what is implied in such a ratio of 40 is of interest. In

considering the income implications of such ratios it is necessary to make allowance for the difference between earnings and yield. If one-fifth of earnings is withheld a price-earnings ratio of 40 means a dividend return of 2 per cent.

The present payment of $100 for $2 a year the first year is justifiable only by the expectation of an increase in this rate in future years. We will assume a regular increase of income, beginning with $2 a year, by equal relative steps from year to year for the period 15 years ahead. Allowing compound interest annually, an income of $6 a year for 15 years is the equivalent of an income for the same number of years beginning at $2 and increasing by 32 per cent each year up to $16.50 for the last of the 15 years. To anticipate such a rate of increase is expecting a good deal. But this comparison takes no account of the difference between the $6 income and the income rising from $2 to $16.50 as the two series may be expected to differ after the 15th year.

It is obvious that a very high price-earnings ratio can be justified by an increasing rate of return on an investment in the future. But will the income increase regularly, for a long period and at a high rate? A 32 per cent per year rate is certainly high. If the increase from $2 is at the rate of 16 per cent per year, the final rate (for the 15th year) is 8 per cent. An income increasing regularly from $2 to $8 in 15 years is worth much less than a constant income of $6 a year. This difference is not compensated by the difference between 6 per cent and 8 per cent return from the 15th year on, though of course it may be made up by a further increase in the 8 per cent rate as compared with a stationary 6 per cent rate.

The factor of the expectation of life of earnings cannot be dealt with by mere compound interest calculations, however, without making certain assumptions that deprive the results of most of their practical significance. Computations based upon calculations of compound interest do not take account of the risk factor. A 16 per cent income certain beginning 15 years ahead is worth not very much more than a 6 per cent income certain from now on, according to compound interest computed at 6 per cent. If untouched till the 15th year the 6 per cent series is worth 14.4 per cent from the 15th year. Is the difference between this and 16 per cent sufficient to balance the risk to an individual to whom "a bird in the hand is worth two in the bush"? Hence the importance of the variability of the earnings term of the price-earnings ratio, such variability being the pertinent aspect of risk that is amenable to statistical analysis.

As regards comparative variability of gross revenues, operating expenses and net earnings (or net income) the last series (or either of

the last two) should be expected to show greater year-to-year variability than either of the other series. In this comparison variability must be measured relatively, not absolutely. One dollar change in net is more than a dollar change in gross, on the valid principle that an inch on the end of one's nose is a good deal. For the rest, it is necessary to call attention to certain rather abstract statistical considerations.

The variability of a series obtained by averaging, or by adding, the items of two other series is less than that of the component series, and in general less than that of either of them.

The variability of a series obtained by subtracting the items of one series from the corresponding items of another is greater than that of the two series combined and in general greater than that of either of them. As a statistical proposition this applies directly to the comparison of the variability of net earnings with that of the constituent series, gross earnings and expenses.

The variability in question, that of net earnings, may as well mean a tendency to marked upward as to marked downward movement. It does not suggest the stability and security of a level attained by a marked upward movement. On very general grounds, a high rate of earnings may be expected to show less stability than lower rates.

At this point it would be appropriate to bring to bear statistical data of corporate reports and to state some inductive generalizations based upon them. Some basic data of this nature have been examined for a dozen or twenty large corporations, chiefly with the result of showing their inadequacy for statistical purposes. Many do not show gross earnings or gross revenues, or, if they do recently, the series does not run for as much as ten years. Other series are better represented, although not on an evidently comparable basis as between different corporations; and their significance, with gross revenues not shown, is limited. Possibly something might be done with the situation, nevertheless, with more time to devote to the matter than I have had. As it is, instead of presenting results of statistical induction, I can only offer certain general statements, which are rather theoretical, having reference to the possibilities of the rate of regular increase of net earnings or net income, as the case may be. They may be regarded as queries, though not put in the form of questions. If it is true that usually statistics prove what is obvious, it is not presumptuous to make such statements in advance of statistical evidence.

An increase in net implies a like increase in gross, in the long run and in general. This follows if the gross manufacturing and handling margin remains about the same, or tends to distribute itself regularly

about an average. Above the average will be found certain industries, or certain establishments in them, that have not yet got their growth; while below generally will be found establishments in declining industries, their situation being largely merely the other side of the story of the rapidly growing ones.

An increase in net behind which the associated increase in gross lags is in general not consistent with effective competition in or with the industry. This brings the rate of increase in net into relation to the rate of growth of population and of national income, of course with a qualification as regards particular industries that has just been mentioned.

The principal alternative condition under which an increase in net may be maintained without a corresponding increase in gross is the possession of some degree of monopoly power. But this is not a basis upon which a *regular and continued* increase in net may be expected, because the drastic exercise of monopoly power courts its own destruction; and nothing would strain the situation more than an attempt to increase a monopoly's net year after year at a rate much above the rate of increase in national income. This statement is made with due consciousness of the fact that the control of a wide-ranging distribution system carrying large fixed expenses implies some slight degree of monopoly power. Even under such conditions, however, large profits do not appear to propagate themselves at a geometrical rate.

The more fixed capital an industry employs—or, more generally, the greater its overhead—the greater the variability or year-to-year fluctuation of net earnings. To state the proposition in a way to suggest the mechanism involved—the greater the overhead per dollar of output, the less the flexibility of expenses and charges and the greater the degree to which any variation of gross earnings impinges upon, or is magnified in, the variation of the net. A collateral consideration relevant to this situation is the increasing importance of overhead. In many lines a 20 per cent decline in the volume of business makes the difference between very good business and very bad business. The larger the enterprise, moreover, the greater appears to be the difficulty of controlling overhead.

The public pays too little attention to what is back of the variability of net earnings. Even such formal considerations as those advanced above are too much neglected. But it is pragmatically much more important that knowledge of concrete facts regarding the business of all corporations selling securities to the public be made accessible to them. To this end improvements in corporation reports and in the accounting methods back of them are much needed. As regards the practical

importance of uniform methods of accounting for each industry the activities of the trade associations in this direction are sufficient evidence. The New York Stock Exchange is moving in the direction of requiring more adequate published reports. In both respects, however, it would appear that compulsory measures may become requisite in the public interest. Marked progress in these respects, however, will not do everything for the investor that he would like, chiefly because of the limitations inherent in accounts.

Accounting results at best have not the definiteness that accountants and others often assume that they have. Criticisms of the proposition that depreciation is an operating expense to be spread over the useful life of the property affected interest me chiefly as evidence of the large element of estimation entering into accounting results. Depreciation (and depletion, likewise) can only be estimated. This situation suggests to me that depreciation is a statistical rather than accounting problem. At least I wish to believe that the accountant does not do as much guessing—orderly guessing, of course—as the statistician is compelled to do. In this connection I would add that the experienced statistician will insist that the roughest approximation is always preferable to simple omission from a total. The application of this proposition to accounting for depreciation is obvious. It is to be inferred, also, that net earnings are always more or less mere estimates. Unfortunately the investor cannot get much satisfaction or enlightenment out of this.

The point of view of the business man who wishes to be "conservative" in determining his income and assets is worthy of sympathy. An individual or partnership is properly permitted to indulge in such conservatism without stint. But the management of a corporation whose securities are broadly held by the general public is morally bound to hold an even balance in such matters. Under such circumstances consciously to swerve to one side or the other is in effect dishonest. Sound principles of accounting may in general involve "conservatism" of a sort, especially in the valuation of certain assets at cost. Information as to the date of the booking of such assets might well be furnished in such cases. Their writing up does not meet the need of impartial and truthful presentation of the facts to stockholders and potential stockholders.

FEDERAL CORPORATION STATISTICS

By E. Dana Durand

For convenience this discussion is confined chiefly to statistics of manufacturing corporations but much of what is said concerning them is likewise applicable to the statistics of concerns engaged in other fields.

Other papers of this session have referred principally to the need on the part of the investor of more accurate accounts and statistics for individual corporations. The point of view of the present discussion is different. The Federal Government (except in special cases where it exercises regulatory functions) does not publish data for individual corporations, and whether in the future there may be some change in practice in this respect is problematical. It is possible, however, to obtain data of great economic and financial importance from combined totals for groups of corporations. These may be of only indirect service to the investor in buying securities, but they are of service to the economist and the general public in enabling them to understand the character and trends of American business.

The census does not collect statistics of corporations as such, but from time to time in connection with its general reports concerning the manufacturing industry of the country it does make the distinction between corporate and non-corporate concerns. At certain of the recent biennial censuses, in order to simplify the presentation, this distinction has not been made, but it was made in 1919 and will be made again in the current census covering the year 1929. It is possible from such census data to determine for manufacturing industry in general, and for individual industries and groups of industries, the proportion of the total volume of business which is done by corporations.

The Income Tax Unit has as its main purpose, of course, the collection of revenue. As evidence of the correctness of the net profits for taxation, however, it requires many other data, including a fairly detailed income account and balance sheet. The Income Tax Unit has recognized the value of this information for general economic and statistical purposes, and it annually presents analyses of the returns from that point of view.

As far back as 1919 the census showed that corporations did seven-eighths of the total manufacturing business. The proportion is undoubtedly considerably higher now. In view of this dominance of corporate ownership it is possible, although to a rather limited extent, to make joint use of census statistics and income statistics as regards

manufacturing industry, each supplementing the other. The census for the most part omits questions relating to financial matters, though it covers the very important subjects of value of products (or of sales), the cost of materials, fuel and power, and the amount paid for salaries and wages. It does not call for other items of expense, nor for profits, nor does it have any inquiries regarding assets and liabilities, the former questions concerning capital invested having been dropped by reason of the unsatisfactory character of the returns. The income tax schedules, on the other hand, provide, as already stated, an abundance of financial data. In consequence, by making estimates for non-corporate concerns, one may arrive roughly at an income statement and balance sheet for all manufacturing enterprises combined.

Moreover within certain limits the income tax returns, which are obtained annually, can be made to fill in the gaps between the biennial censuses of manufactures. (It is very possible that in the near future the need for any such supplementation of the census will cease, since the census itself may be taken annually, as has been recommended by the Advisory Committee set up by the Secretary of Commerce.) For example, the change in the value of sales of manufacturing corporations from 1927 to 1928, as reported by the Income Tax Unit, should reflect very closely the ratio of change in the total value of manufacturing output including that of non-corporate concerns. This holds true despite the fact that many individual corporations report sales to the Income Tax Unit on a different basis from that contemplated by the census schedules. The figure for aggregate sales of manufacturing corporations in 1927, as published by the Income Tax Unit, corresponded fairly closely with that for all manufacturing concerns, as published by the Bureau of the Census, when allowance is made for the unincorporated enterprises.

Such supplementing of census data by income tax data as has been suggested is practicable in any satisfactory manner only with respect to totals for manufacturing industry in general. Such totals possess less economic interest than data for groups of industries and individual industries. In particular, the gross value of sales for all manufacturing concerns combined is full of duplication, resulting from the sale of partly finished products of one concern to another for further manufacture. While the changes in gross value of sales from year to year are highly significant, the absolute amount is practically meaningless. When, however, we turn to the problem of correlating census statistics with income tax statistics as regards individual industries or groups of industries, we are confronted with grave difficulty. We cannot fit the separate reports of individual concerns together in such a way as to assure close comparability.

The Income Tax Unit, to be sure, has followed the general lead of the census as regards classification of manufacturing industries. It distinguishes ten major groups. Certain of these conform directly in name with corresponding groups distinguished by the census, while the others represent combinations of census groupings; the census, it will be remembered, distinguishes sixteen major groups. Moreover the Income Tax Unit has broken down its ten groups into some forty subdivisions. Certain of these, at least in name, correspond with individual industries as defined by the Bureau of the Census, while others represent combinations of two or more of the census classifications.

This attempt of the Income Tax Unit to follow in a broad way the census system of grouping has important advantages, but it fails to assure any real comparability between census data and income tax data. The Treasury officials of necessity treat each corporation as a unit and classify it according to its principal business. The Census Bureau, on the other hand, makes the individual plant the unit of its report. In this modern day of integration a single corporation may own directly or indirectly several or many plants, and these may be engaged in more or less distinct lines of business, so that the census would classify them under different industries. While there is considerable overlapping between fields even in the census classification, the overlapping is much greater in the case of income tax data.

As a consequence it is not possible, as regards any given census group such as that of textile industries, or as regards any individual industry, to supplement the census statistics of value of products, cost of materials and amount paid for salaries and wages, by statistics of other items of expenditures or of net profit or of capital employed derived from income tax returns.

It is not necessary, however, in order to make effective use of income tax statistics for general economic purposes, to tie them up closely with census data. Notwithstanding the overlapping in the classification a broad view of the situation and the changes in different fields of manufacturing industry could be gained from the corporation statistics of the Income Tax Unit as they are in fact classified, provided the latter data are comparable from year to year. What is essential is that the income tax data should be made consistent within themselves, apart from any question of consistency with the census data. The classification should be made as nearly correct as the facts of business will permit. Where, as is bound to happen in a good many cases, a corporation changes the scope of its business or merges with some other corporation, special analyses might be undertaken to assure a greater degree of comparability of the statistics for successive years. Resort

may be had to the familiar device of presenting data for those parts of the total for a given field which are directly comparable, in addition to comparisons as affected by changes in the basis of classification.

The Income Tax Unit could increase the value of its returns for economic purposes in various ways. For one thing it might add to its schedules a limited number of easily answered questions which would serve to round out the picture of corporate activity. There may be some question as to the constitutional or legal right of the Income Tax Unit to demand information for purposes not connected with taxation, but a number of inquiries not now on the schedule might very well be justified on the ground that they afford a check on the accuracy of the calculation of net income. For example, the schedules might be so adjusted as to assure a greater uniformity in the basis of the reports of gross sales, such reports, as already stated, lacking uniformity at present. Questions might be added concerning the average number of employees (or still better, for such concerns as keep records thereof, the number of man-hours worked) together with the amount of wage and salary payments. Again the total cost of materials, of fuel, and of electric current, as one item or as three separate items, might be called for, thus making possible the publication of a figure corresponding with that so much emphasized by the Bureau of the Census—the value added to materials by manufacture.

Another method of making the income tax statistics more useful would be by the introduction of additional schemes of classifying corporations according to size. Hitherto the only classification of this sort used by the Income Tax Unit has been that based on the amount of net income. It distinguishes, for example, corporations with a net income of under $5,000, those whose income is from $5,000 to $10,000, and so on up, the highest group being corporations with an income of $5,000,000 or more. This classification is very useful, but owing to the variability of profits from year to year and from industry to industry, it has decided limitations. It would seem worth while to classify corporations according to the magnitude of their gross sales, and the amount of their capital, and also, in case the question concerning employees should be added, according to the number of their employees. For corporations as classified according to these respective bases, all the major facts from the income account and the balance sheet could advantageously be presented. It may be noted that the Census Bureau classifies plants (not concerns) according to two standards of size: that of the number of wage earners employed, and that of the gross value of products.

Both the Bureau of the Census and the Income Tax Unit might well

undertake to furnish us with more information regarding multi-plant concerns. One of the most striking phenomena of modern business is the grouping of several or many plants under a single control. In this matter we need not think in terms of combinations or mergers of formerly separate plants, and still less of combinations that may be considered as in restraint of trade. Many large corporations have themselves established, through no process of merger, several or many plants. It is very desirable that more information should be available regarding all such multi-plant organizations.

After the Census of 1919 the Bureau of the Census published a monograph regarding the integration of industry. The data related largely to so-called central office concerns; that is, to concerns which furnished to the Census Bureau schedules for two or more separate plants each. The monograph set forth, as regards each field, the number of central offices and the number of plants controlled by them. It also made a rough size classification by grouping the central offices according to the number of plants controlled by each. No data were presented, however, as to the magnitude of the operations of these central office concerns, though the editor of the monograph hazarded an estimate on that subject. It would seem feasible at the census of 1930 to repeat this study of central office concerns, and to go further, by showing the magnitude of their operations as indicated by such items as number of employees, value of products and value added to materials by manufacture. All that is necessary for this purpose is to punch on the card for any given factory the fact that it was reported through a central office, and to tabulate these cards separately from those of the plants which report directly to the Census Bureau. Such totals would not fully measure the importance of multi-plant concerns, since there are some cases in which the individual plants controlled by such concerns report directly to the Census Bureau instead of through the central office. The disparity, however, would be moderate in degree, since it is usually more convenient for a multi-plant concern to report all its plants through its head office.

The Income Tax Unit might likewise contribute to our information regarding multi-plant concerns. It would seem possible and reasonable to add questions to the schedule concerning the name, location and character of business of the separate plants owned directly or through stock control by a given corporation. On the basis of this information various analyses as to the proportion of total business done by multi-plant concerns might be made, as well as comparisons of the magnitude of the business done by concerns possessing different numbers of plants.

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The Income Tax Unit might possibly (though the problem is more

difficult) go still further in furnishing us with needed information regarding the structure of American industry. We need obviously to know more about the scope of the operations of the large corporations and the character of their inter-relations one with the other. What kinds of business are considered by our enterprisers as sufficiently related to justify bringing them under a common control? What methods of control are used, and what are the tendencies with regard to such methods? It is somewhat difficult to picture a method of presenting information of this character without disclosing the business of individual corporations, but an adequate study of the subject would doubtless reveal some practicable ways of adding to our knowledge along these lines.

The corporation income tax is a relatively new thing. It was natural and proper that during the War and for a considerable time thereafter the Income Tax Unit should devote its effort primarily to the task of securing more correct returns of net income. That will always remain its principal object, but the time seems to have come when more attention and more expenditure should be devoted to the exploitation of the great mine of economic and financial information whose potential wealth lies in the dominance of the corporate form of organization in American business. The Federal Government is extending its statistical service in various directions, and at the same time it is seeking to secure better coördination of statistical effort. It would seem proper that it should devote much thought to the better utilization of income tax returns for general statistical purposes.

DISCUSSION

By J. F. Ebersole

As to the desirability of having more comprehensive current corporation reports with which to determine the present and prospective values of securities, there can be no disagreement.

Superficially it appears that the situation requires merely the passage of a law compelling corporations to publish the kind of statement desired. Such a law probably cannot be passed unless supported by a body of opinion larger than that now existing with reference to this subject. The basic problem is an educational one. The typical American investor does not conceive of himself as purchasing an *income*. The possibility of obtaining a profit is more often the uppermost thought in mind when securities are purchased. Until American investors become more generally interested in the purchase of incomes,

there will continue to be substantial sums of investment capital available to those corporations offering a mystery and the hope of profit, rather than detailed statistics giving assurance of their efficiency and continuity. Corporations seeking capital have long recognized this situation. A substantial number of corporations need this speculative market in which to float their securities, particularly the newer concerns as well as those of truly speculative character. Therefore, until the objectives of American investors have been changed, or until we have concluded that the time has arrived to abolish new and speculative enterprises, there will exist and be a need for a zone of so-called investment which is no more or less than "buying a pig in a poke."

In the interim, until a considerable body of opinion has been developed bringing about the desired end by legislation, it may be that some progress can be made in the direction of leading corporations to supply more comprehensive information, particularly in cases where that information would appeal to the true investor. It may be that investment counsel, and other persons and institutions directing the flow of investment capital for those seeking the best possible incomes obtainable in the long run, may, quite informally, establish what may be referred to as a "white list" of those corporations voluntarily giving adequate information. By refusing to purchase or recommend the securities of other companies, it may be that in the reasonably near future considerable pressure may be exercised upon other corporations, by virtue of public opinion and by the relative advantages to be obtained in the capital market, to furnish the desired information. Certainly there are in existence today enough corporations giving comprehensive information to provide a satisfactory quantity of securities for true investors. There is no need for those who are trusted with the management of the funds of others to experiment with, or gamble in, other securities regarding which they are not able to obtain the facts. Investment counsel following any other policy than that of proceeding upon published information or exact information obtained in other ways is hardly worthy of the name and its implication of professional ethics.

Of all the other statements made in the papers that have been read, there is but one to which I wish to direct attention and suggest some modification. It has been stated that the statistics of income figures regarding American corporations, as taken from the corporation returns, tabulated and published in the Bureau of Internal Revenue, afford information valuable for comparative purposes as to the condition and earnings of American corporations by industrial classifications; and that in the future these should be extended considerably by more

elaborate requests for information upon the income tax returns filed. It is very important, in my opinion, to state that the statistics of income data heretofore published must be used and interpreted in the light of their origin, inasmuch as they were gathered for tax administration purposes and not primarily for American investors and economists. One must proceed cautiously in using such data in order to be assured that the definitions and concepts applied to the returns and tabulations are really what they appear to be in the mind of the hopeful investigator seeking evidence with reference to some preconceived problem. A comprehensive and specific catalogue of the difficulties to be encountered in using the statistics of income data appears in the November, 1929, issue of the *Review of Economic Statistics*.

As to the future elaboration of data by industrial groups, I frankly confess a distressing skepticism as to the value of what may be developed. There appear to be almost insuperable difficulties in isolating businesses by types of industry or class, because (a) consolidated corporation returns are filed for the more important corporations covering in some cases as many as eighty different corporations scattered over a number of different industries; and (b) a single corporation filing a single return may be engaged in a number of industries by virtue of integration, and its return, like that of consolidated corporations, must be classified in a single industry according to opinion, or the facts in each particular year, as to the predominant source of its income. To ask corporations to isolate sources of net income according to industrial classifications would involve, in order to obtain exactness, the determination of many controversial questions regarding the distribution of overhead and a degree of interference on the part of the Government with regard to corporation accounts which would not be tolerated. There are a number of additional reasons why figures for industrial classifications in practice, both past and prospective, would be of doubtful value for comparative purposes.

EVALUATION OF ECONOMIC FORECASTS

By Garfield V. Cox

This paper is primarily an explanation of *methods* used in a recent evaluation of economic forecasts.[1] The appraisal in question covered the ten years, November, 1918, to October, 1928. The services whose predictions I evaluated were chosen because they are widely known; have published forecasts quite regularly throughout all, or nearly all, of the period under review; and represent a varied assortment of forecasting theories and techniques. The services covered are Babson's *Barometer Letter; The Brookmire Forecaster;* the *Monthly* and *Weekly Letters* of the Harvard Economic Society; Moody's *Weekly Letter* and *Monthly Analysis of Business Conditions;* the *Daily Trade Service* and *Trade and Securities Service* of Standard Statistics Company; and the monthly bulletin of the National City Bank. The forecasts appraised are those which relate to the course of *general business activity*. The study assumes that the course of business is adequately represented by certain well-known business indexes to be mentioned later.

When one attempts to measure the success with which the services have anticipated such movements as these indexes reflect, a number of questions arise. Should a prophecy which points to a continuance of business stability or of an already existing rate of expansion or contraction receive the same weight as a prediction of the beginning of a business decline or upswing? And should a forecast of a *major* movement receive a different weight from that accorded the prediction of a *minor* movement? It may be argued that what the client most needs is to be warned of major changes, yet he might be anticipating a major change when none, in fact, was impending, and might, therefore, be as much benefited by being told not to expect one, as by being correctly advised at another time that a major change was imminent when he otherwise would not have been prepared for it. Or, it might be argued that the amount of credit merited by accuracy in forecast depends upon the difficulty of predicting the development in question, and that minor business cycles have confounded forecasters more generally than major ones.

A further difficulty exists in the fact that, whatever the method of evaluation adopted, the results obtained may be expected to vary with the individual judgment of the appraiser. In order that others

[1] *An Appraisal of American Business Forecasts*, by Garfield V. Cox; in School of Commerce and Administration Series; Studies in Business Administration, University of Chicago; Chicago, December, 1929.

might more readily appraise the forecasts as a check upon my own results, I extracted from the writings of each service for each month one or more short quotations most representative of the service's opinion as to the business outlook. As a protection against bias in selection, I tried to assume the viewpoint of a contemporary reader of the service. There was always the risk, however, of selecting not that which would have impressed the reader at the time of issue, but that which in retrospect is rendered striking because it proved either notably correct or decidedly wrong. As a check against this possibility I procured the services of three intelligent students who were not yet well informed concerning the business fluctuations of the decade in question. These students made independent selections of quotations from all of the services for sample periods. Their choices were enough like mine to suggest that my selections were representative. Although the removal of the quotations from their qualifying contexts often heightens the impression of definiteness of the prediction, this does not appear serious, for the method of scoring devised penalizes a service for being definite when wrong as much as it rewards the service for being definite when right.

Accepting these quotations as representing the predictions of the services, I applied two separate tests in their evaluation. The first assumes that the reader of a service needs a monthly series of definite forecasts and that correct advice is worth as much in one month as in another. On this basis one starts with the forecasts and checks these against subsequent events. The second test starts with selected turning-points in an index of business activity and turns from these to the preceding forecasts. It assumes that the client's need is to be warned of major turning-points in business. On this basis the forecasts which call for appraisal are those for a period of months preceding each of the selected turning-points.

The system of grading adopted for Test No. 1 rests upon the assumption that the value (positive or negative) of a forecast depends in part upon its definiteness and in part upon its validity. The more definite the prophecy the greater its probable value to clients if right and the more harmful its influence if wrong. For each month each service is, therefore, assigned a grade for *definiteness* of forecast and a grade for *correctness*. Scores for definiteness range by quarters from 0 to 1. Scores for correctness range by quarters from -1 to $+1$. The grade given for *adequacy* of forecast for any month is obtained by multiplying the score for correctness by the score for definiteness. Scores for adequacy also range, therefore, from -1 as the maximum penalty for failure to $+1$ as the maximum reward for success.

If a prediction failed to indicate for how long it applied, it was assumed to be for the period which the service in question has most often attempted to cover. Greater definiteness was required concerning the *character* of the predicted event if the service appeared to have expected it almost at once than if it had been thought to lie farther in the future. If the most general prediction for a given month related to a limited field not closely correlated with indexes of general business, the forecast was rated low in definiteness no matter how clear-cut it may have been concerning the limited field.

In checking for correctness I asked not how much more correct a forecast could have been made, or was made by someone else, but, rather, how sound or unsound a step it would have been to have shaped policy in conformity with the forecast. Where the most general prediction made concerned only a limited field, the forecast was checked solely against subsequent developments in that field. Where the prediction concerned the course of a designated index of general business, the forecast was checked against that specific index. If a general forecast mentioned no index, it was checked against three different indexes of business activity, including that of the service in question if it had one, and always including at least one of three indexes not connected with any of the services. These three were the *Annalist* index of business activity, the American Telephone and Telegraph Company index of business activity, and the index of the volume of trade of the Federal Reserve Bank of New York. The last-named index was used when the nature of the forecast indicated that it should be checked against the most inclusive index available. In the few instances where discrepancy appeared between a service's own index and the outside indexes employed it was assumed that the truth lay in a compromise of the differences.

The average scores which I obtained by the foregoing method, together with the composite results obtained by eleven graduate students at the University of Chicago who applied the test independently to the same quotations, are as follows:

	My own scores	*Average of eleven student scores*
Standard Statistics Company	.54	.40
Babson's Statistical Organization	.48	.38
Harvard Economic Society	.34	.29
Brookmire Economic Service	.32	.32
Moody's Investors Service	.24	.15
National City Bank	.23	.22
Average of the foregoing	.36	.29

If the 687 monthly predictions involved had been random guesses, the most probable average score would be zero, for nearly all the forecasts relate to prospective deviations of business from an estimated normal trend. An average score of .36 would, therefore, appear significant, especially since two-thirds of the scores from which it was computed lie within the range of $+\frac{1}{4}$ to $+\frac{3}{4}$ inclusive, and since, for the whole range from -1 to $+1$, positive scores outnumber negative ones by approximately 5 to 1. The distribution of student scores is similar. Such results signify either a positive bias in the measurement or a considerable degree of success in forecasting.

We turn now to Test No. 2, which inquires how successfully the services have predicted *major turning-points* in business. The turns here designated as major are those in the *Annalist* index of business activity which initiate a rise or decline of more than 12 points. This index was chosen because it was independent of the services subject to appraisal and yet similar in composition to the indexes which most of the services maintain. Major upturns occurred in this index in March, 1919; March, 1921; July, 1924; and December, 1927; while major downturns took place in March, 1920; May, 1923; and March, 1927.

In grading each service upon its success in predicting these turns one might adopt a rigid rule such as that each should be scored for each month for a half-year period just prior to each turn. There are, however, several objections to this procedure, the most serious of which is that the index sometimes made a double top or bottom. After comparing the forecasts with the index the scoring of every service for each turn was begun at the first month in which any service predicted it. Scoring was continued slightly beyond the date of turn, since clients need to know whether a turn just made is significant or not. On this basis the number of months for which forecasts were scored for different turns varies from 8 for the upturn of 1919 to 19 for the upturn of 1921.

The rules for scoring employed assume that a service was most helpful when it predicted definitely and correctly the *direction*, *amplitude*, and *time of inception* of the approaching movement. A service which, prior to a major turn, was either silent or predicted continuation of the existing level of activity, is assumed to have done its clients neither good nor harm. It is treated as having misled them only when it predicted change in the wrong direction. If a service forecast a *major* movement in the wrong direction it is treated as more misleading than if it had predicted a *minor* movement, and when it pointed in the wrong direction it is assumed to have done worse if it was definite and right about the *time* of the turn than if it had been vague and wrong. In

scoring a succession of forecasts, the later predictions must be more definite than earlier ones to receive a given score.

The system of scoring adopted was as follows: For each month the score for adequacy of forecast depends upon the definiteness and correctness with which the service predicted the *direction*, *amplitude*, and *time of inception* of the major swing in question. Scores for both the *amplitude* and *time* factors range by increments of $\frac{1}{6}$ from 0 to $\frac{1}{2}$, and the sum of the two is the score for adequacy. The sign given this score is minus if the prediction is for a movement in the wrong direction, and plus if for a movement in the right one. Thus, as in Test No. 1, scores for adequacy range from -1 to $+1$.

Again my own results were checked by those of the same eleven students working independently. Comparing my scores with theirs by periods, there were only three instances of marked discrepancy, and each of these related to a situation which I had found especially difficult to score. Designating as one case the average score of each service for each turn, my own scores are positive in 33 cases out of 40, negative in 6, and zero in 1. Student averages are positive in 32 cases out of 40.

Speaking qualitatively I should say that the services were definitely helpful in 13 cases out of 40, slightly helpful in 18, neutral in 5, slightly misleading in 2, and definitely misleading in 2. A majority of the most successful anticipations relate to the collapse of 1920 and the recovery of 1922, which suggests that major cycles are easier to predict than minor ones. Both of the serious mistakes relate to the downswing of 1923–24, and appear to have been due to over-emphasis upon the power of abundant bank credit to sustain business activity regardless of other factors. Two additional instances of considerable error during the decade escape detection by Test No. 2. Both were predictions of important declines in 1926 and were based on the belief that industrial production had for some time been running considerably in excess of normal. All other predictions of major change fall within the periods scored under the second test and have contributed, positively or negatively, to the scores obtained.

APPRAISAL OF ECONOMIC FORECASTS

By Seymour L. Andrew and Harold M. Flinn

This study of the degree of success achieved during recent years by a miscellaneous group of organizations which have made forecasts of general business activity was undertaken a short time ago at the specific request of the sponsors of the program for this meeting. In view of the brief period of time available for making the study, it was necessary to use short-cut methods in so far as possible. The study must be regarded solely as a high-spot investigation and the results are presented merely for whatever they may be worth. At the same time, it is interesting, and perhaps significant, to note that these results agree closely with the results of the much more elaborate analysis made independently by Professor Cox.

The problem of appraisal consists in ascertaining, first, what was forecast; second, what happened; and third, the extent to which the forecast was realized.

Of these three factors, the determination of what actually happened affords the least difficulty, because of the wealth of data which have been compiled and analyzed in recent years. In the case of such specific phases of business activity as short-term money rates and wholesale commodity prices, the principal compilations show a high degree of similarity; and even in the case of stock price movements, with respect to which there has been some question of late as to whether the previously accepted "averages" have continued faithfully to represent the significant trends, such collateral evidence as is provided, for example, by the movements in brokers' loans would seem to confirm the continued existence of what is commonly meant by "the market" and to afford reasonable reassurance as to the validity of these averages, at least as bases against which to check forecasts. On account of looseness of definition, "general business" affords perhaps the most difficulty. Many forecasters, however, either maintain an index of their own which purports to represent general business activity or else speak in terms of one of the recognized curves. In cases where there is no such specific basis for appraisal, there is sufficient agreement as to major movements among most of the available general business indexes to permit evaluation of forecasts covering periods of reasonable length.

As to what was forecast, there is rather more difficulty. Forecasts are stated more often, for example, in qualitative than in quantitative

terms, abounding in such expressions as "generally good business," "no real depression," or "comparatively easy money," which are subject to various interpretations. Such definite comparisons as "higher than the last half of this year," "above normal," or "a decline comparable to that of 1923," which permit of somewhat more exact appraisal, are encountered only occasionally; and quantitative statements like "commercial paper will drop below 4 per cent" or "production of automobiles will be between 5 and 5½ million cars" are still more rare. Another outstanding obstacle lies in the fact that the period covered by the forecast is not always clearly indicated, many opinions being ventured as to the outlook for no more specific interval than "the near future" or "the next few months." Again, forecasts are not infrequently made with such reservations regarding possible changes in European conditions or federal reserve policy, to mention only two of the favorite provisos, that the reader is left in doubt whether they can really be accepted as predictions.

The appraisal itself also offers some difficulty. Lacking quantitative forecasts, it would appear necessary to abandon any attempt to determine measures of degree of error, and to resort, instead, to some form of categorical classification having as its objectives the determination of relative frequency of helpful as compared with detrimental forecasts, the comparison of success in forecasting various elements in the economic structure, and comparison of success in forecasting a given element at different times. If a number of forecasters are to be included in the appraisal, however, we are confronted with differences in the frequency with which forecasters or "services" customarily express their views and in the period into the future for which they attempt to predict; and find that opinions as to the future are stated sometimes in terms of movement and sometimes in terms of level.

Eleven forecasters were chosen from among a number several times as large, principally on grounds of availability over a sufficient period of years. Of these, five are so-called "commercial services" and the remainder include university, periodical, and strictly private sources. Forecasts made during November and December of each of the six years from 1923 to 1928, inclusive, for the ensuing calendar year were considered, and in addition to opinions on the outlook for general business, forecasts were obtained, where possible, for five specific items: wholesale commodity prices, short-term money rates, stock prices, building construction, and automobile production. In spite of certain obvious disadvantages in limiting consideration to calendar year forecasts, it is customary in the conduct of business generally, and consequently with some reason in the making of forecasts, to attach

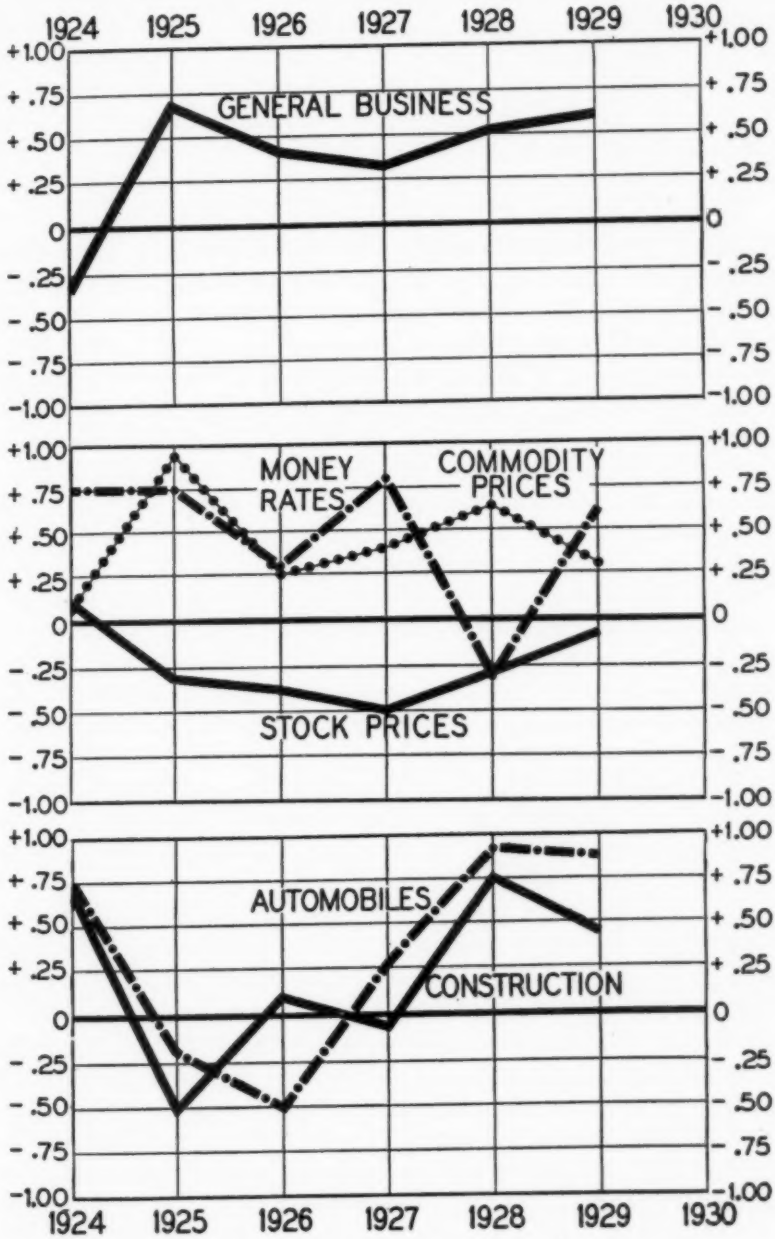
special significance to the outlook around the end of each year. The emphasis on these year-end forecasts would seem, therefore, to render them particularly suitable as bases for appraisal. The particular six-year period selected probably contains sufficient variety of conditions and movements to afford a somewhat illuminating test.

The first step in the investigation consisted in transcribing, after careful perusal of the bulletins and letters in question, brief quotations representing, as fairly as possible, and with due consideration of context, the opinion on the outlook for each year. In every case statements both as to level and as to movement were sought, the period which the forecast was designed to cover was noted, and special attention was paid to any definite comparisons or quantitative information which might be of value in the appraisal.

In order to allow for a reasonable amount of discrimination between forecasts, at the same time avoiding excessive refinement, five categories were used in the classification, as represented by the following words: good, fair, questionable, poor, and bad. Each forecast was graded separately on the scores of movement and of level, using the compilations of the forecaster or forecasting service in question, where available, to indicate what actually happened. For purposes of summarization, these ratings have been converted into numerical measures by assigning a value of $+1$ to "good," $+\frac{1}{2}$ to "fair," 0 to "questionable," $-\frac{1}{2}$ to "poor," and -1 to "bad." The various summaries mentioned are averages of these ratings, and range between limits of $+1$, the value that would be attained if all forecasts received a "good" rating, and -1, representing uniformly "bad" grades.

For the entire group of forecasters, for all years, combining ratings on level and movement, a composite measure of $+.39$ for forecasts of general business alone was found. This figure indicates a fair prevalence of success over failure, and compares in a general way with the figure of $+.36$ on a similar scale of measurement obtained by Professor Cox for a smaller group of forecasters, with measurements taken, however, at more frequent intervals and over a somewhat longer period of years. As to the five specific subjects also investigated, it is found that forecasts of money rates, commodity prices, and automobile production during this period have been somewhat more successful, if anything, than those of general business; that forecasts of building construction, while appreciably less successful, are still on the favorable side; and that in the single case of stock prices, have forecasts during these years been wrong more frequently than not. Below are tabulated the general ratings and the adjoining chart shows the results for each subject by years. Aside from stock prices, the outstanding

ACCURACY OF FORECASTS



errors in prediction are found in the failure of correctly anticipated easy money to stimulate business in 1924, over-bearishness on construction in 1925 and on automobile production in 1925 and 1926, and failure to foresee the 1928 rise in interest rates.

General business	+.39
Wholesale commodity prices	+.46
Short-term money rates	+.51
Stock prices	−.26
Building construction	+.19
Automobile production	+.44

Because of the fact that few of the critical points in the business fluctuations of these years have happened to coincide with the ends of calendar years, a number of dates during this interval were selected at which all the general business curves considered were in agreement as to the imminence of a turning point or of a pronounced movement, and investigation was made of the accuracy of prediction, as to general business alone, at these points. These dates mark the culmination of the sharp but brief rally in the early months of 1924, the bottom of the ensuing decline, the beginning of the decline in the last half of 1927, and the peak of mid-1929. In addition, as a sort of "catch question," a date in the spring of 1926 during the latter stages of the decline in stock prices was inserted. Opinions were secured as closely as possible to the dates listed below, with the results shown. The method of rating was the same as that employed in the investigation of calendar year forecasts. These measures, together with that for the 1928 forecasts, which coincided closely with an upturn, indicate a fair record on turning-points, with the notable exception of the 1924 decline.

March 1, 1924	−.48
August 1, 1924	+.53
April 1, 1926	−.04
August 1, 1927	+.03
July 1, 1929	+.37

The results of another investigation which has been carried on over a number of years in connection with forecasts of the prices of certain specific commodities are of interest as throwing additional light on this matter of appraisal of economic forecasts. This study, which covers recommendations of each of four commercial services on the purchase of each of ten commodities by months for the four-year period 1925 to 1928, inclusive, and, allowing for omissions, includes over 1,500 separate forecasts, was made in connection with the actual purchase of these commodities. Each recommendation was relegated to one of three categories according to whether (1) the purchaser would

have saved money by following the advice of the forecaster, (2) would have about broken even, or (3) would have lost money, taking account of the customary policy as to commitments. It was found that 51 per cent of the forecasts fell in the first class, 24 per cent in the second, and 25 per cent in the third. If, in order to compare this result with those discussed above, we assign values of $+1$, 0, and -1, respectively, to the three categories in the order mentioned, we obtain a composite rating of $+.26$. Thus, the results of this somewhat more rigorous test, comprising a rather large number of instances, do not differ markedly from those previously discussed.

In conclusion, it may be stated that a representative group of forecasters appear to have stood the test of these appraisals with a sufficient degree of success to prove that they have been, on the whole, helpful to business men; and the increasing use of scientific methods of analysis promises improvement in the future.

DISCUSSION

I

By Donald Tucker

Professor Cox has presented an excellent paper. It is a brief summary of his still more excellent monograph, *An Appraisal of American Business Forecasts*. My discussion today will therefore be directed primarily toward his *Appraisal* rather than toward the briefer summary he has presented here.

Before venturing to criticize one aspect of his method, I desire to record my substantial agreement with his results. Once I also ventured to appraise the work of three of the business forecasters. These were Babson, Brookmire and Harvard. My results agreed with his, as I understand his results, in the following points:

(1) Two of the services tested were apparently slightly more accurate in forecasting the behavior of their own index of business, than in forecasting the behavior of any other business index by which we attempted to test them. Apparently each service—as was but natural—had devoted its chief thought to its own index.

(2) Using a slightly briefer period than his—we conducted several tests. In all our tests we discarded those statements which were too vague to be interpreted as forecasts. The remainder were tested by two standards, of which one was a five months' moving average centered six months ahead.

The forecasts for commodity prices (exclusive of those discarded as indefinite) were classified as follows:

Helpful	83 or 51.9 per cent
Neither helpful nor injurious	28 or 17.5 per cent
Wrong	49 or 30.6 per cent

In testing business volume we used the Department of Commerce index of manufacturing and the forecasts were graded as follows:

Helpful	119 or 59.8 per cent
Neither helpful nor injurious	42 or 21.1 per cent
Wrong	38 or 19.1 per cent

These results can be converted—rather roughly, it is true—into the Cox scale by counting each helpful prediction as $+1$; each wrong prediction as -1, and those neither helpful nor injurious as 0. Measured in this way our results for prices would be .21; for volume .41; for all forecasts tested in this fashion .32.

If we had used as our standard a five months' moving average centered three months ahead, our results if converted to the Cox scale would have been apparently .53, the higher figures being due largely to the forecasters' relative success in the short-term prediction of volume.

If our two partial tests were to be combined, and the results reduced to the Cox scale, we would give an average rating of .37, as compared to Professor Cox's .36 for all prophecies.

(3) My results are quoted only rather hesitantly because the original records of my investigation were destroyed during my absence in the summer of 1928. I cite this summary of my results then only to indicate two things, (a) my substantial approval of Professor Cox's results, and (b) the extent to which I believe the results of any numerical rating in this field can be influenced by factors present in the mind of the one who does the grading. I am impressed by the extent to which Professor Cox's work agrees with that of his students.

(4) The second test made by Professor Cox was on the success of the services in predicting the major turns of business. On this he secures, I believe, a score for the three services of $+.15$. For this test we discarded our numerical score. We examined the forecasts for six months prior to each major turn, and discovered that we could manipulate the results somewhat by changing that period, and by treating the six months as one interval, instead of six. Our results seemed too arbitrary to present in figures, but we also came to the conclusion that the success of the forecasters was notably lower at the turns.

(5) With respect to their success at major turning points it seemed at first that there was a real difference in our results; but the detailed

statements shown by Professor Cox on his mimeographed sheets make clear that that difference is due chiefly to one item. In 1920 we rated the Babson service higher than the others, largely because of the definiteness of their warning both as to the approach and extent of the decline and also the distance ahead at which that warning was given.

So far as Professor Cox's results are concerned, therefore, I offer no significant criticism. It is only in one matter of method that I would disagree. He uses two tests for each forecast. These are correctness and definiteness. I venture to suggest that three tests are necessary: correctness, definiteness, and completeness. It was a difference in completeness, for example, which caused the difference in the 1920 rating cited above. It is much more difficult to give a reasonably complete forecast which is both accurate and definite than it is to forecast that one element in the situation whose behavior seems most certain. An important test of any service, it seems to me, is "Does it give the business man what he wants to know?"

This aspect of the subject may be most readily presented by first clearing the ground of two problems which are in part problems of definiteness.

The first problem finds numerous illustrations. The following is perhaps typical. A prediction of "generally favorable business for fall" was issued at a time when business was far above normal. Almost immediately after the issue of this prophecy, business started to decline rapidly but the average for fall was still well above normal, chiefly because of the large volume of business included in the first two months. Compared with a long trend normal, business was therefore favorable. Compared with a short term average, business was distinctly unfavorable. Which had this service prophesied?

The next problem lay in deciding the date to which each prophecy referred. In one September for example, there is a prophecy, "prices to react upward." Prices actually continued to decline for four months, but in the following February a strong upward movement appeared whose effects lasted more than a year. Was this prophecy correct?

Even if the forecast is definite, its relative completeness is a matter of importance. There are, it seems to me, two things which a business man needs to learn from his economic service. The first is the nature of the period which is now going on, whether declining, advancing or stationary. In this the present services are at their best. The second is the probable nearness and probable direction of the next change.

In this respect a prediction recently issued by the Harvard service forms an example of what would seem to be the perfect prediction. It reads:

> Today a depression seems improbable, and continuance of business recession is all that is in prospect. This justifies a forecast of recovery of business next spring, with further improvement in the fall, so that 1930, as a whole, should prove at least a fairly good year.

This forecast states clearly the nature of the present period and when the next change is likely to come. In form it is perfect. If it only proves to be right, it will be perfection itself.

I have ventured to use much of the brief period allowed for the preparation of my remarks in gathering information of one kind only. That information concerned the period in advance of the present for which forecasts were most desired. I was able to get replies with respect to 29 corporations which had introduced or had planned to introduce operating budgets. The information was secured from people who were associated either with the budget control or with the plans for budget control rather than with the specific forecast of sales. Unfortunately, this sample was not only small, it was probably not truly representative. Among other difficulties it was overloaded with textile and boot and shoe concerns. At best it includes only 20 industries.

My first question was, "Assuming that you do not speculate in your raw material, what would be the most important period for this company in forecasts of *prices*?"

Some of the concerns questioned were, it appeared, especially interested in the prices of more than one major commodity.

Taking first the answers for the commodity for which information was desired furthest in advance, the median of their answers was 6 months. The average was 6.3 months.

Next, taking the commodities which required the shortest interval for readjustment, the median was again 6 months, and the average 5.9.

With respect to a number of these companies it was volunteered that a much shorter interval only was necessary to prevent real loss. One officer even stated that for his company this shorter interval would be only 15 days provided those days formed the last half of the month. Even this 15-day interval may be longer than is necessary for some companies. No question was asked as to shortest useful interval. I tried to secure only the interval most desired. That was six months; but the supplementary material volunteered suggests that three months or perhaps even less would have been practically sufficient for most of these companies.

The need of advance information on this point is being therefore well met by the present services. Three, and occasionally six months, seem to be the interval they normally have in mind.

A rather different set of answers appeared to a set of questions re-

ferring to production volume. Here one concern answered that the important period was "at least one year." That answer could not be converted into a specific number of months. But the median for the group, whether we take the shortest or the longest time needed was 12 months, and the average was over 9.

Here also was volunteered the information that any forecast was helpful. But production volume in general requires the assembling and training of men and thus requires for its proper performance a period considerably longer than that covered by the usual forecast of some of the services.

II

By Arthur W. Marget

The methods devised by Professor Cox strike me as most ingenious, and are probably as nearly adequate as any we are likely to devise, *for the type of appraisal of business forecasts which Professor Cox had in mind.* Such objections as it is possible to raise, once Professor Cox is met on his own ground, strike me as essentially captious, and I shall not pause to examine them here.

On the other hand, it seems to me that we have the right to raise the question whether the general standpoint from which Professor Cox proceeds is the only possible standpoint. Professor Cox raises the question: "How 'good' were these forecasts, from the standpoint of a *business man*, who looked to them for guidance, and was prepared to act and to incur risks, in accordance with their prognostications?" This is a fair question, and I think that Professor Cox's paper provides a fair answer to it for the last ten years. Yet we have a right to ask another question, which I cannot help feeling must ultimately prove to be the more important question: "How 'good' were these forecasts, from the *scientific* standpoint?" Now, no one has stressed more than Professor Cox himself the difference in quality between the "working standards of the business man and those of the scientist." I am, therefore, not pointing out to Professor Cox anything he doesn't know. What I want to ask, however, is this: Granting that the problem of economic forecasting is amenable to scientific treatment, how applicable and how satisfactory are Professor Cox's methods of appraisal from the standpoint of the standards which such forecasting should set itself? I think it is possible to argue that, when once this point of view is adopted, some other method of rating would have to be devised. I can make this clearest, I think, by taking up each of Professor Cox's criteria—"definiteness" and "correctness"—in turn.

I begin with "definiteness." Now, one may admit, though I think the point can be argued, that Professor Cox is justified, *from the standpoint of his criterion of appraisal, viz., "helpfulness to the business man,"* in regarding "definiteness" as being of exactly equal importance with "correctness." Business men must act: A forecast without "if's" or "buts" makes it possible to act without hesitation: To that extent, from the standpoint of Professor Cox's criterion, it is a "better" forecast. What place, however, should "definiteness" hold in a system of appraisal which proceeds from the standpoint I have suggested: viz., that of scientific validity?

I think we can agree, at the outset, that there is a type of "indefiniteness" that should be penalized under a system of appraisal from any point of view, and that is the "indefiniteness" which purposely takes the form of a very Delphic utterance, so obscure in its implications that, after the event, no matter what that event proved to be, the forecasting agency could claim that its forecast was correct. Yet there is another type of "lack of definiteness" which certainly should not be penalized, certainly not to the extent of making it, as do Professor Cox's methods, as damaging as a positive error. In fact, I believe it is possible to defend the proposition that, from the scientific point of view, there are many cases in which we ought to penalize *definiteness.* Professor Cox's methods penalize definiteness only if the forecast turns out to be wrong: A procedure which strikes me, from our point of view, as a kind of Spartan morality, according to which the sinner is punished, not for his sin, but for being caught in the act of sinning. My point is that, in many cases, the only scientific position possible is one of *indefiniteness.*

There are, of course, reasons for hesitation which apply with special force in the present state of both our statistical information and our theoretical knowledge with respect to the forces controlling industrial fluctuations. Yet it is important to notice that there will always be circumstances, whatever the state of our statistical and theoretical knowledge, under which a definite forecast cannot be made if we are to follow the dictates of our scientific conscience. The material basis for a revival of business activity may be present, for example, and yet the actual timing of such a revival will depend on the vagaries of entrepreneurial psychology. A "definite" forecast as to the timing of the revival, under such conditions, can hardly lay claim to any basis that can be regarded as "scientific." So with respect to the problem of forecasting, at the very outset of the boom, the *duration* thereof; very much indeed will depend upon which of the several conceivable courses that theory can describe as possibilities, will actually come to be fol-

lowed as the boom progresses; and a definite forecast made in advance of the appearance of evidence that one particular possibility has begun to be realized, is again without scientific basis. There are still other conditions under which a qualified or "conditional" forecast will always be necessary. If, in any one of these cases, a venturesome forecaster should undertake to foretell the future with perfect definiteness, his forecast should be rated low, from the scientific point of view, even though, by a lucky chance, it should turn out to be "justified" by the subsequent event.

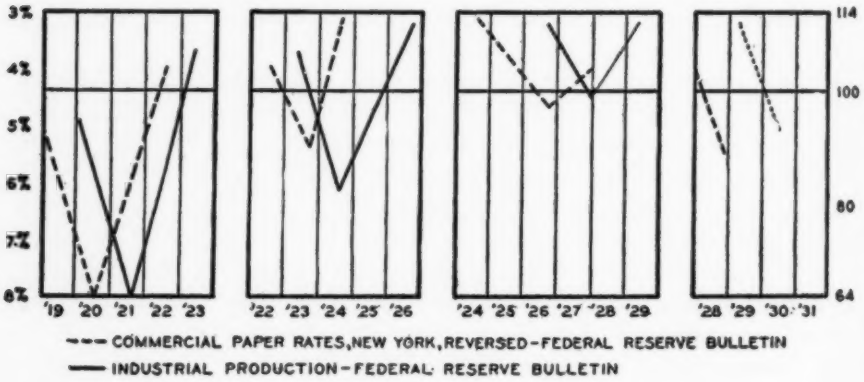
The situation is very much the same, when we ask what differences from Professor Cox's results with respect to the grading of forecasts for "correctness" would follow from adopting the scientific point of view. In general, for example, Professor Cox "weights" his grades for correctness according to the seriousness of the consequences to the enterpriser of the adoption of a policy consistent with the implications of a given forecast. Thus, a mistake in the forecast of a "major" turn is penalized more heavily than one in forecast of a "minor" turn. Yet it must be obvious that the seriousness of the consequences to the enterpriser, while it is a relevant consideration to one proceeding from Professor Cox's frankly avowed standpoint, is quite irrelevant to a judgment concerning the correctness of forecasts, as such. If it be argued that a minor movement is more "difficult" to forecast than a major one, and that therefore mistakes in forecasting minor movements should be less heavily penalized than mistakes in forecasting major movements, the answer should be that, from the scientific point of view, the presence of a greater number of uncertainties in the situation is simply an argument for "indefiniteness" in forecast, not for leniency in judging mistakes made as the result of a refusal to take seriously the boundaries set by the requirements of strictly scientific procedure. In the same way, I think it possible to argue that Professor Cox's conclusions with respect to other problems of weighting would have to be modified once the standpoint from which the appraisal is being made is not "usefulness to the business man," but, instead, the scientific validity of the analysis itself.

III

By John G. Thompson

Since 1919 I have been working with Alvan T. Simonds, President of the Simonds Saw and Steel Company, trying to convince business executives and others interested that major movements in money rates, reversed, forecast major swings in business. As business, or general

business, or business activity are all so indefinite and hardly any two persons agree as to their meaning, we have used the volume of manufacture, as reported by the Harvard Economic Society, or the volume of industrial production, as reported by the Federal Reserve Board. We have found that major movements in these are forecast by major swings of money rates, reversed. The particular series of money rates selected, however, must be as free as possible from the influences of speculation. Therefore we have selected commercial paper rates, New York. The accompanying chart shows that each major swing in commercial paper rates, reversed, is followed some months later by a major swing in industrial production. The major swings are represented as straight lines connecting the peaks and the valleys of the three-year cycle, which has been repeated now four times since the War. Minor swings,



including seasonal swings, have been neglected, but in each case the extreme high point has been connected with the next extreme low point, or the extreme low point with the next extreme high point. The heavy dotted line running downward through 1928 is commercial paper rates, reversed. The light dotted line beginning in the spring of 1929 and running down to the middle of 1930 is the estimated course of industrial production, as made in December, 1928. The chart represents the movements as falling in three-year cycles and shows each cycle separated from the others.

This chart was presented at the meeting of the American Statistical Association in Chicago in December, 1928, in exactly the form in which it appears here. It was again presented at the meeting of the same Association at Washington, D. C., December, 1929, without change of a single mark or line.

In attempting to convince those interested that (as this chart shows)

money rates, reversed, do forecast major swings in business, the chief difficulty seems to be the long lag between the corresponding movements. The general belief seems to have been, and to be, that when money rates ease off, business immediately or almost at once turns upward. As a matter of fact and as the chart shows, this upward turn does not begin until several months later.

Just now everyone is forecasting an upturn in business sometime in 1930, largely because money rates turned down the first of November, 1929. They have been easing now for three months, but no major upward swing in business has begun. In many lines of business there will be a minor seasonal upward swing this spring, without doubt, but the highest point of this minor movement will not be so high as the high point from which business turned down in 1929, that is, the major swing which began in 1929 on this chart will be represented as a straight line connecting June, 1929, with the bottom of the valley which will probably come near the end of 1930; that is, money rates reversed will be moving upward for a year or longer before business turns upward.

It is hoped that the present experience (we might say the current experience) will convince everyone that if declining money rates bring about a turn upward from poor business, it will not be until after some months of such declining money rates. We tried to make this point clear at the meeting in Chicago in December, 1928, and also the following point. At that time money rates had begun to increase, that is, reversed, they were on the declining line and if this line continued to decline, it indicated a falling off in business to begin sometime in the middle of 1929. Money rates continued to increase from near the end of 1927 to November, 1929. Why then was it not apparent to everyone that this major swing of increasing money rates would be followed, as it had been in every case since the War, by a decline in business beginning from nine to eighteen months later?

If this were all hindsight, we should feel less assurance about convincing others. As a matter of fact, since 1920 Alvan T. Simonds has been calling attention to the truth of this particular forecast, and in the last two years through *Looking Ahead*, which is published every two months and outlines business prospects. This is sent gratis to those who care to receive it. Every major swing, upward or downward, has been forecast months ahead and the forecast made in print at the time. This has not come as the result of some uncanny, clairvoyant power but simply because of the truth that major movements in money rates do forecast in the United States major swings in industrial production, and in general business, if anyone knows what that is.

If this truth had been generally known and applied, the stock

market smash of October and November, 1929, would never have occurred. The increase of stock prices to unreasonable heights was based on the belief of a new era in which outstanding companies among those most successful would continue to increase their earnings forever, with, of course, increasing dividends forever, thus bringing about constantly increasing stock prices for such securities.

THE FOREIGN TRADE OF 1929

By E. Dana Durand

Foreign trade in times of peace is in most countries a rather prosaic subject from a statistical standpoint. It is not likely to show any such spectacular movements, either up or down, as we have witnessed, for example, in the stock market. The forces at work are largely of a continuing character. The variety of products exported and imported and the wide geographic range of the field of trade tend toward uniformity in the general trends of the totals, changes in one direction here being offset by opposing changes elsewhere.

The year 1929 witnessed somewhat more marked changes in certain aspects of our foreign trade than have been customary in most recent years, but nevertheless there were no extraordinary phenomena. Broadly speaking the trends characteristic of the period since the end of the world depression of 1921 have continued during the year just closing. There has been throughout that period a steady and strong upward tendency in both our exports and imports, reflecting the growing efficiency of American production and of American salesmanship, the improvement in economic conditions pretty much throughout the world, and the advancing buying power of our own people for foreign raw materials, foodstuffs and manufactures.

Just how much the foreign trade of 1929 surpassed that of the year before is not known at the time of this meeting. If December shows the same figures as the corresponding month of 1928 our total exports will amount to about $5,300,000,000, and our imports to about $4,450,000,000, the increase for the former being between 3 and 4 per cent, and for the latter about 8 per cent.[1] Since imports have increased more than exports, the balance of commodity trade in favor of the United States was considerably less than in 1928, when it amounted to $1,037,000,000. That balance, however, was still large, somewhere between $800,000,000 and $900,000,000, materially exceeding the corresponding figures for 1925, 1926 and 1927. There was a very considerable inflow of gold during the year considered as a whole, but this can scarcely be explained as due to the excess of commodity exports, since during 1928, despite a still larger excess of exports, gold had flowed out in exceptionally large quantities. The explanation of the imports of gold in 1929 was rather the situation in the stock market, and the

[1] Actual figures proved to be: exports $5,241,000,000, or 2.2 per cent over 1928; imports $4,400,000,000, or 7.5 per cent increase.

change of that situation toward the close of the year was reflected in a marked reversal of the gold movement.

It is impossible at this early date to discuss intelligently the general result of our international financial transactions during 1929. As is well known to economists, the relations between the numerous items in our international balance of payments are highly complex. Movements of capital into and out of the country have played a great part in recent years. These movements are exceptionally difficult to measure, especially those connected with stock market and banking transactions.

The export trade of the year just closed showed more than the usual variations from month to month. The gain in the total, as compared with 1928, was substantially confined to the first four months during which our foreign sales were nearly $300,000,000 larger than in the corresponding period of the year before. In no month after April was there a very large increase in exports over the corresponding month of 1928, and in May, October and November exports were materially less than in the same months of the preceding year (data subsequently published for December likewise showed a decrease). The decline in October and November was due partly to smaller shipments of agricultural products and partly to a falling off in exports of automobiles which during the early months of the year had shown an abnormally heavy increase.

The export of manufactured goods in 1929 continued the very marked increase which has been characteristic of practically every year since 1921. The foreign sales of factory products, including semi-manufactures as well as those ready for use, reached about $3,250,000,000, with a gain of approximately 10 per cent over 1928, and of 80 or 90 per cent over 1922. The export of finished manufactures, which was about three times as great as that of partly finished articles, was approximately 200 per cent greater last year than during the average year from 1909 to 1914, even after allowing for the higher level of prices now prevailing. Before the War this group represented about three-tenths of the total exports of the United States, whereas it now makes up half of the much larger aggregate. Although the United States still exports a much smaller proportion of the products of its factories than do England and Germany, the foreign sales represent roughly one-tenth of the output, and have become an important factor for the stabilization of industry and employment.

The increase in the total exports of manufactured goods during 1929 was shared by most individual commodities, a large number of which made records for all past time, if adjustment is made for the fact that prices are now much lower than during the war period. Among the

commodities which were exported to a greater value than in 1928 may be mentioned heavy iron and steel products, more advanced products of iron and steel, machinery, automobiles, chemicals, cotton manufactures, paper manufactures, gasoline, lumber, and advanced manufactures of wood. In most recent years petroleum products have ranked next to cotton in the list of exports, but in 1929 the second place was taken by machinery with a total of more than $600,000,000 and a gain of about 20 per cent over 1928. Automobiles (including parts, etc.,) ranked fourth, foreign sales of which amounted to about $540,000,000, with a gain of 8 per cent. The increases in the value of exports of finished manufactures were, in nearly all cases, due chiefly if not wholly to larger quantities, little or no advance in unit prices appearing. In the group of semi-manufactures, however, a conspicuous increase in the value of exports of copper occurred despite some decline in the quantity sold, the price having risen materially under strong world demand.

The total value of agricultural exports in the year just closed was somewhat less than in 1928. This fact was due chiefly to reduced exports of cotton and tobacco. The value of cotton exports had been exceptionally large in 1928. The relatively small cotton exports during the closing months of the year were an important factor in bringing down the aggregate for all commodities combined. Foreign sales of foodstuffs as a group showed little change from the preceding year. There was some decrease in the export of wheat and a marked decline in barley and rye, but on the other hand meat products, lard, corn, and fruits and nuts showed gains. The increase in sales of meats and lard abroad was in contrast with the general downward tendency in most recent years.

The prices of a number of major import commodities were lower in 1929 than the year before. If adjustment is made for price changes the increase in imports, instead of being 7 or 8 per cent, would rise to about 15 per cent, an unusually marked gain. The fact that the value of imports for the year just closing was only about the same as in 1926 must be interpreted in the light of very marked price declines. In 1925 and 1926 rubber prices soared. Since then they have fallen greatly. The average unit value for 1926, according to the import statistics, was not far from three times as high as for 1929. There has been on the whole a downward tendency for the last three or four years in the prices of such other major commodities as coffee, silk, sugar and tin.

Many leading articles were imported into the United States in greater quantity during 1929 than ever before. Among these may be men-

tioned silk, rubber, tin, copper (unrefined), newsprint paper, cocoa and sugar. The imports of rubber were more than one-fourth greater than in 1928, reaching a total exceeding 1,250,000,000 pounds; there was, however, no increase in the value of rubber imports. In the case of cocoa, paper, tin, and numerous other less important items, the percentage of increase in value from 1928 was less than that in quantity by reason of declining prices. Copper imports showed a very marked increase over 1928. They represent, to a large extent, the output of American-controlled mines, and most of them are in unrefined form for further treatment by American plants.

Turning from this consideration of individual commodities in the foreign trade to the data for broad economic classes, we find that the increase in our exports in 1929 as compared with the preceding year was substantially confined to the group of finished manufactures, there being little change in semi-manufactures as a group, or in foodstuffs, and a considerable decline in the group of raw materials, due chiefly to the smaller exports of cotton and tobacco. On the other hand all four of the major groups of imports showed increases. Despite the lower prices of a number of crude materials that group as a whole showed a gain of about 7 per cent. The decidedly larger gain in the class of semi-manufactures was partly due to the higher price of copper. Foodstuffs imports increased only slightly. The group of finished manufactures, the value of which is less affected by price changes than that of any other group, increased by nearly one-eighth in value, reflecting the high buying power prevailing for articles of a luxury or semi-luxury character which constitute a very considerable proportion of our imports of manufactured goods.

Data regarding the geographic distribution of our trade are available only for the first eleven months of 1929 and it is impossible to estimate very closely the year's totals. The available returns show a slight decrease in exports to Europe and Asia, but imports from all six of the continents increased. For exports the highest percentage of gain appears in the trade with South America. The increase in exports to Canada was also conspicuous, and there was some gain in shipments to the Latin countries and islands of North America, in contrast with the somewhat declining tendency in a number of preceding years. Imports from Europe and from Asia, the two largest sources of supply, both increased by roughly one-tenth, while the purchases from South America and from Africa were from 15 to 20 per cent larger than in 1928. The increases in imports from North America and Oceania were less pronounced.

Without attempting to make any definite forecast for 1930 it may be

stated with some confidence that the general upward trend of exports of the United States is likely to continue in most years of the near future. Exports of manufactures have now become the dominant factor in our foreign sales and the world demand for these tends to increase steadily.

PRODUCTION AND PRICES IN 1929

By Joseph L. Snider

The production of commodities was in great volume during the first part of 1929; during the latter part of the year production has been curtailed. Commodity prices, on the average, have shown no substantial change. These are the general features of the year.

How great was the volume of production during the first part of the year? The index of industrial production published by the Federal Reserve Board, which includes both manufactures and minerals and which is adjusted for seasonal variations, rose sharply during the first half of the year to a level in June, 26 per cent above its 1923–25 average. For the first 6 months of the year the index averaged approximately 20 per cent above its base. These levels were higher than any previously attained. The natural growth of industry from year to year was partly responsible for the record levels, to be sure, since the Board's index is not adjusted for secular trend. But, even with the trend allowed for, production reached record levels. The index of the volume of manufacture published by the Harvard Economic Society, which is corrected for trend as well as for seasonal variations, rose in June to the highest figure ever recorded, 19 per cent above estimated normal. The peak of this index in 1923 was 13 per cent above normal, and the peak in 1920 was 15 per cent above normal.

The steel and automobile industries were chiefly responsible for the high levels attained during 1929, although the majority of industries experienced increased activities during the first half of the year. On the other hand, there were several lines of production—cement, wool textiles, leather, coal, and petroleum—in which opposite tendencies were shown.

The curtailment of production began in July and was the natural sequel of the extremely high levels reached earlier in the year.

How substantial has the curtailment of production been? Again utilizing the index of the Federal Reserve Board, the decline during 5 months from the high point of June through November (the latest month for which the index is available) has amounted to 15 per cent. By comparison, the decline of production in 1927 lasted 8 months and amounted to 12 per cent; the 1924 decline lasted 5 months and amounted to 17½ per cent; and the 1920–21 decline lasted 13 months and amounted to 32 per cent. The index of the Harvard Economic Society, which includes manufactures but not minerals, has also de-

clined for 5 months. The decline has amounted to 18½ per cent. In 1927 the decline lasted 6 months and amounted to 14 per cent; in 1924 it lasted 5 months and amounted to 18½ per cent; and in 1920–21 it lasted 16 months and amounted to 37 per cent.

Thus, the decline in production has already (through November) been more severe than the decline in 1927, not nearly so severe as in 1920–21 and approximately equal to the decline in 1924. December figures will almost certainly show some further decline so that, without making any forecast as to production in 1930, it is safe to say that the current decline will be at least slightly more severe than the decline in 1924. However, the volume of manufacture has not yet fallen as far below estimated normal as was the case in 1924. The index of the Harvard Economic Society has fallen approximately 5 per cent below normal on the current decline, whereas in 1924 it fell to a point 12 per cent below normal. Moreover, at the low point of the depression in 1921 the index stood 28 per cent below normal.

With reference to commodity prices during 1929, stability is the most significant characterization. The range between the high point and the low point of the index of the Bureau of Labor Statistics thus far during the year is less than in any preceding year since the War. Moreover, no appreciable tendency either upward or downward has persisted throughout the year. The prices of non-agricultural commodities have been even more stable than the prices of agricultural commodities. Such stability of prices during a period of record-breaking industrial activity is indeed significant.

The prices of individual commodities have as usual shown greater fluctuations than the general average. During the year the prices of cotton, wool, corn, wheat, hides, rubber, and non-ferrous metals have undergone considerable variations.

Finally, it should not be overlooked that prices in general have fallen moderately during the recent months of declining production. The index of the Bureau of Labor Statistics fell 3½ per cent from July through November.

THE 1929 AGRICULTURAL SEASON

By A. B. Genung

The picture of agricultural conditions really presents itself in two phases. First, there is the current aspect, the conditions developed as an outcome of this particular season. Then there is the broader, background aspect arising from the decade of amazing events through which we have been living since 1920. No one year's developments stand alone and unrelated in these readjustment times. However, a 10-minute review must be limited practically to the current, foreground part of the picture.

The farmers of the United States had this season approximately 367,000,000 acres in crops. This was about 1 per cent more than the acreage harvested last year, a large part of the increase being in hay. The acreage of cotton was increased 1.4 per cent and wheat about 5 per cent over last year, whereas potato acreage was reduced 12 per cent and corn 2.5 per cent.

The crops were planted under the handicap of a rainy and backward spring season. So much so that the northern sowing of oats ran way along into June, and corn planting into July.

During early summer, by contrast, the weather became very dry. By midsummer, a large part of the country was in the grip of drought conditions. In Iowa, for example, there were nine weeks during which the rainfall averaged about one-third of normal. In various local sections like southern New England, New Jersey, and the Pacific Northwest, the drought was the most severe in a generation.

Finally, September brought general rains, the frosts held off fairly well, and the late crops improved substantially.

The net effect of the season was an average yield per acre of all crops combined, 5.3 per cent less than last year but only 2.2 per cent less than the latest 10-year average. Aggregate crop production was about 5 per cent less than last year. In a general way, it may be noted that the great crops of the northern United States—the food and feed crops, wheat, corn, oats, potatoes, and fruits are all smaller than last year, while such leading crops of the South as cotton, tobacco, sweet potatoes, and peanuts are apparently somewhat larger than last year.

Perhaps the quickest way to sketch in some seasonal details is to note very briefly the case of certain key lines of production. There are some eight farm products which are fairly representative. As go these, so goes the general picture of agricultural production, movement

and prices. These eight lines are wheat, cotton, potatoes, corn, beef cattle, hogs, dairy, and poultry.

The final estimates place our spring wheat crop at 228,172,000 bushels, compared with 336,203,000 bushels last year, and winter wheat at 578,336,000 bushels, which was practically the same as last year's crop. Growers in the northern spring wheat territory were hard hit by the drought and generally regard this as a lean year.

The tendency this past summer was to move wheat to market very promptly, a tendency furthered by use of the combine and by the dry, favorable harvest time. The July and August movement to primary markets, amounting to 185,000,000 bushels, was much in excess of those months in any other recent year and resulted in a well remembered congestion at the terminals. By September, shipments had fallen off markedly below the same month last year.

The Government report of this last week indicates an increase of about 2 per cent in winter wheat acreage sown this fall, as compared with that of a year ago. This includes increases in Texas, Kansas, Colorado, and Montana, but decreases in Oklahoma, Missouri, and the Pacific Coast.

Cotton is the country's greatest cash crop, bringing annually well over a billion dollars to its producers. The crop this year (14,919,000 bales) is estimated to be 441,000 bales more than last year. The average farm price on December 1, however, was 16.4 cents a pound this year, against 18 cents last year. Consequently, the farm value of the total crop, as of December 1, amounted to $1,225,032,000 this year, compared with $1,301,796,000 a year ago. There is a possibility, however, that the ultimate income realized by the South, from cotton, will not greatly differ this year from last.

Cotton, like wheat, also began to move early in the fall. The ginnings up to November 1 totaled 10,889,314 bales, compared with 10,162,482 bales ginned to same date last year, while after November 1 the ginnings fell below last year.

The acreage of potatoes this year (estimated at 3,370,000 acres harvested) is about the same as 10 years ago and, indeed, about the same as 20 years ago. The total crop, placed at 354,000,000 bushels, is one of the two smallest since 1921. The reduced acreage planted this year was due partly to the unfavorable spring weather but even more to a natural reaction from the large crop and ruinously low prices of a year ago. The supply is centered farther eastward than in other recent short crop years, Maine producing about 13 per cent of this year's crop, or 3 per cent more than the average ratio.

Here again the tendency was to move a substantial part of the crop

promptly into trade. By September 1, the early crop had been practically used up. By mid-November, the late potato states had shipped 14,650 carloads more than last year up to the same time.

With a crop approximately one-fourth smaller, the price of potatoes is twice as high as a year ago. The increase of some $200,000,000 over last year in the value of the potato crop represents the largest item of added purchasing power for this season's crop growers and more than offsets any probable decreases in cotton and wheat.

The area of corn, America's great feed grain, has been stabilized for 10 years at about 100,000,000 acres. The big factor which determines the variations in crop from year to year is the weather. The value of the corn crop is rather a nominal matter. It is actually realized largely in terms of hogs and cattle.

The crop of corn this year is estimated at 2,622,189,000 bushels. This is 200,000,000 bushels less than last season, but the carry-over of old corn was about 25,000,000 bushels larger this fall than last.

A word now in regard to the livestock industries.

The packers bought, during the first 10 months of this year, a total of 9,077,000,000 pounds of hogs, live weight, for which they paid producers $936,000,000. Farmers received $87,000,000 more for 52,000,000 pounds less of hogs this year than in the same period last year. The average cost to packers this year was $10.32, last year $9.31 per hundred pounds.

The December pig survey made by the Department of Agriculture indicates a present fall pig crop about 4 per cent larger in the Corn Belt than last fall. After making due allowance for under-indications, as hitherto revealed in these spring and fall surveys, it appears that the total commercial pig crop this year was a little larger than last year. Similarly, the number of sows farrowing next spring in the Corn Belt will be apparently about the same as farrowed last spring.

In the case of beef cattle, 6,620,000,000 pounds, live weight, were slaughtered under Federal inspection during the first 10 months of this year. This was slightly less (52,000,000 pounds) than the total slaughter of the same period last year. For this amount of live beef, the packers paid producers $716,400,000 or slightly less ($2,000,000) than last year. The average cost to the packers figures out to $10.82 this year, compared with $10.76 last year per 100 pounds.

Cattle feeders have had a poor year, in contrast with the profitable 1928 season. Nevertheless, there are about as many cattle on feed now as a year ago.

The basic cattle situation is less determined by the circumstances of this or any particular year. The cycle of cattle production and

prices is usually about 15 years in length. It has been a quite regular and periodic affair since 1880. There are 13,000,000 fewer cattle in the country now than there were in 1920. Cattle production apparently is now going through its low phase, and prices the high phase of the cycle, the latest cyclical upturn in prices having become well defined in 1926. If history repeats itself, the peak of cattle prices will occur during 1930 or 1931, and if we may learn anything from experience, it is that in respect to production, the cattle industry should now be watching its step.

The butter market suffered a drastic slump last month, influenced by cold-storage stocks some 25,000,000 pounds heavier than the average stocks on November 1, by the crash in the general speculative markets, and by an apparent slowing up in consumption. November butter prices fell to the lowest for that month since the War. This butter situation is, perhaps, something of a warning signal set for dairy producers.

The dairy industry as a whole has continued up until recent weeks in relatively favorable position, with a fairly stable spread between milk and feed prices and with no great change from last year in the total volume of milk production. Farmers still regard dairy cows as good property, judging from the high prices which they continue to pay for cows and heifers. The tendency during the last six weeks has been toward a rather general increase in milk production compared with a year ago.

In the case of poultry, the 10 per cent increase in number of pullets this fall has brought the total laying stock this winter up to or slightly in excess of last winter's numbers. On the whole, egg production this year has been moderate, stocks light, prices well sustained, and the poultry industry has done well.

In general, the country's livestock population has been shrinking steadily for 10 years, marked especially by the decline in numbers of horses and cattle. Reducing all livestock, young and old, to terms of animal units (an "animal unit" being the equivalent of one mature horse or cow) there were on farms 97,501,000 animal units at the beginning of 1920. This number has fallen steadily down to 82,732,000 at the beginning of this year. It is probable that the number of meat animals will soon begin to increase but the shortage of colts means a continued decline in the horse population.

So much for a few key lines of agricultural production. In general, production this year has been free from either serious shortage or burdensome surplus. Farmers have moved the season's products rather promptly into the channels of trade.

Cold-storage stocks at the end of the year are rather heavy in the case of meats, total stocks of meat amounting to 659,786,000 pounds on December 1, 1929, against 557,734,000 pounds as the 5-year average for that date. Stocks of butter are also moderately heavy but other items are about average.

The export trade recently has been running about like last fall in the case of cotton, somewhat heavier in pork, and lighter in wheat. I leave this item to be developed further in other papers.

The general level of prices of farm products rose slightly up to midsummer since when it has slowly declined. The Department of Agriculture's general index of prices received by farmers (on a 5-year pre-war base of 100) stood, in November, at 136. The index of retail prices paid by farmers for commodities bought stood at the same time at 154. The relatively lowest priced group of farm products this fall has been grains, while the highest groups have been poultry products, fruits and vegetables.

While it is too early to make any very reliable estimate of total gross income, the value of this year's principal crops, based upon prices December 1 at the farm, is approximately $8,580,528,000. This is $85,000,000 higher than a year ago, most of the effective increase being in potatoes. The total amount of money received by producers for meat animals slaughtered under Federal inspection, during the first 10 months of this year, was $1,870,000,000. That is $90,000,000 more than for the same period last year, the increase being practically all represented in hogs.

The farm real estate situation has improved slightly, or perhaps it is more accurate to say it is not quite as bad as in other recent years. Foreclosures and other distress transactions have declined from 22.8 per thousand farms in 1926 to 19.4 per thousand for year ending March 15, 1929.

The value per acre of all farm land, including improvements thereon, declined slightly less than 1 per cent this year ending March 15, last, standing at 16 per cent above pre-war values. Rather wide contact with farmers and country dealers leaves me with the impression that good farms have sold a little more readily this year than at any time since 1920.

Time does not permit any discussion of the background factors, against which the picture of 1929 properly should be cast. The movement of population between country and city, the incredibly sudden rise of the motor vehicle with resulting near extinction of the road horses, the marvelous development of new technique in all lines of farm management, the far-reaching phenomena of the deflation period

—all that amazing and even dramatic sweep of events which has overtaken farmers during this decade, is really a vital part of the picture. Suffice it to remember that agriculture is still struggling through a readjustment period.

The sore spot which has lingered is that disparity between the earnings of the farmer and the earnings of industrial workers generally. Not only is the factual evidence strong on that point but any man who eats, sleeps, and talks with many farmers over the country will inevitably grasp the point of view of the man on the land who still sees his brothers, cousins, and friends making more money for fewer hours of work in shops, factories, on the highways, on the railroads, and wherever the urban wage level prevails. Of course, there has been a great deal of improvement in the farmer's relative position since eight years ago. It may be that this winter will mark an even closer approach to parity, by reason partly of events on the industrial side of the equation. Time will tell.

Agriculture is undoubtedly in position to contribute a stabilizing element to the general business situation this winter. It will be a help, not a drag on business as was true in 1921.

I believe, in summing up the 1929 agricultural season, that the current conditions of supply and markets this fall are as stable and about as favorable to farmers as they were in 1925 and except for that year are the best since 1920.

THE BUILDING SITUATION

By Thomas S. Holden

The construction record of 1929 emphasizes most forcibly the fundamental relationships of investment, construction, and general business in our economic system and the inevitable sequence of adjustments and readjustments between these three primary activities. After the fall in the bond market that took place in the latter part of 1928 and continued to the middle of 1929, falling volume of building and engineering contracts in 1929 was inevitable; after continuous decline in construction contracts, a downward turn in general business activity (and, incidentally, a downward turn in stock prices) was inevitable.

Construction activity has a peculiar importance in the American economic system. It measures our economic and social progress; it provides increased facilities for production and for advanced living standards. We rely on investment of accumulated capital in new living facilities, new production facilities, and in public improvements to effect that necessary distribution of purchasing power which enables general business activity to increase. This is perhaps a more important factor in this country than in any other industrial nation, since we depend more than any other people on a continuously expanding home market for consumption of our products.

Investment funds, consisting of savings and corporation surpluses, exist largely for the purpose of financing growth and expansion. If they are hoarded, business volume is restricted; if they are devoted to purely speculative purposes, they cause serious maladjustments that have to be corrected. In the main, they can only give a proper stimulus to increased general activity by being used to finance construction and new productive machinery; in this way they not only increase our facilities for living and producing, but by transforming capital assets from financial to physical form they effect an increase of distributed purchasing power in the community, which provides the necessary market for increased production.

In 1929, we had a peculiarly anomalous condition of affairs. Corporation surpluses, which represent funds at least potentially available for industrial plant extension and improvement, existed in larger volume than ever before. Although they were employed very largely for such uses, they could not be fully employed that way, because of the danger of creating too large an excess of plant capacity. So, large quantities of such funds found employment in the call-money market,

where they gave support to a bull market already over-extended and helped to prolong it something like six months beyond its normal span of life. Apparently, this kind of employment for capital accumulations does not give that wide distribution of consumer purchasing power that is gained by employment of the same funds in construction.

This, was, of course, not the only financial maladjustment of 1929. The fever of stock market speculation spread to the extent of causing withdrawals of funds from savings accounts, and restrictions of loanable assets in the hands of building and loan associations, thereby causing a reduced volume of private residential building, while scarcity of mortgage money and high interest rates cut down activity in speculative residential building.

While construction was the most important manufacturing industry that suffered considerable losses in 1929 as a more or less direct result of our stock market spree, it was itself not without some maladjustments that called for correction. The principal one was the existence at the beginning of the year of a fairly considerable over-supply of residential buildings—apartments, two-family houses, and hotels. Since residential building is itself to a large extent speculative; since its operations are carried on by large numbers of people who do not have the best means of controlling the volume of production in relation to demand; since its multitude of small unit operations become difficult to finance with the approach of tight money; it is usually the class of building that declines first in a recession period. In 1929 total residential building expenditures declined 28 per cent from 1928, whereas expenditures for non-residential building and industrial and civil engineering work increased a little. Consequently, the 12 per cent decline in total construction expenditures in 1929 was practically in its entirety due to decline in residential building work. This decline has been a fairly potent factor in correcting residential over-supply and demand is now considerably strengthened as a result of our recent reduced volume. Consequently, recovery in this class of building activity in 1930 may be expected with considerable confidence; though it now seems unlikely that recovery will carry the 1930 volume back to the record rates of residential activity that prevailed in the 1925–1928 easy money boom period.

There is a peculiar problem in residential building. The American people keenly desire better houses and apartments, with all that is best in modern design, materials, and conveniences. But the cost of new buildings is too great for more than a small proportion of this nation-wide desire to express itself in effective demand for new buildings. Modern buildings can only be sold or rented at the expense of rendering existing buildings obsolete. It is rather likely that the obsolescence

factor in residential buildings is increasing, but we have not yet arrived at ways of disposing of old buildings as simply as we junk old cars. At the present time an organized movement for modernization of old buildings, particularly houses, is under way. Its progress was doubtless impeded somewhat in 1929 by generally unfavorable conditions. Apparently there is an excellent opportunity for this kind of work to go ahead at an accelerated pace in 1930; estimates of the probable volume of this class of work for this year have run as high as a billion dollars. This is the present method by which the obsolescence problem in residential buildings is being met, and it seems good economic procedure. But, the question arises as to whether in the long run we shall not have to invent radically new residential building designs, with simpler and more economical uses of materials in order to produce housing for a larger market at lower costs. This, however, looks to a future more distant than 1930.

One important result of the financial chaos that prevailed during most of last year was to set back the country's program of civil engineering development just about a year. The principal and immediate cause of this was the continued decline in the market for municipal bonds. The result was a volume of civil engineering expenditures just about equal to that of 1928, in the face of a demand for a sizeable increase. Consequently, there is a big hold-over demand for work of this class, with many projects already planned that have not yet gone ahead, and many projects to be planned at early dates to meet urgent needs. With the stimulus of easier financing through bond issues, and with the encouragement given by the President's business conferences and their attendant publicity, there is assurance amounting to practical certainty that expenditures for highways, flood-prevention, sewer projects, and similar public improvements will be measurably increased in 1930. Along with these engineering projects there will also undoubtedly be large increases in public building projects, many of them long needed and many already provided for by government appropriations. Expenditures for public improvements are likely to show more conspicuous increases in 1930 than any other class of construction work.

Commercial and industrial building expenditures increased considerably in 1929. They usually do increase in a period when general business and stock market activity are on the up-grade, and they are in consequence less likely to have further increase in 1930. Recent surveys have shown rather more than normal percentages of vacancies in large-type office buildings, and this class of work seems due for a quiet period in order that demand may catch up with supply. Manufacturing facilities are not likely to be increased greatly in the coming year,

though plant modernization and installation of cost-reducing machinery and processes are likely to proceed at a satisfactory rate. Large industrial and commercial organizations have ample funds for plant extensions; but fear of creating surplus plant facilities is apt to curb factory building of most classes again in 1930. But, if there should be decreases in factory building expenditures they seem quite likely to be made up by increased power projects and extensions of public utility facilities.

Summing up the prospect for the coming year, the volume of construction expenditures in this country may be expected to increase in 1930 for four important reasons:

1. The turn in the money market, so dramatically ushered in by the stock market break of late October, releases investment money for construction purposes at favorable interest rates;

2. The President's business conferences have thrown the spotlight on the necessity for construction to go ahead in order to stabilize business and have encouraged those controlling important projects to make early decisions to go ahead;

3. There is a very considerable demand for public improvement projects, both buildings and engineering work, that has not been taken care of; and

4. The rather drastic decline in residential building that took place in 1929 has done much to correct the conditions of over-supply that existed in this class of buildings at the opening of the year and has thereby increased residential building demand to some extent.

If there is decided improvement in the contract record before the end of the first quarter, construction expenditures may quite possibly increase as much as 10 per cent over 1929.

So much for the general review of 1929 and the prospect for construction activity in 1930. There are some additional historical details in the records of construction and related activities during the past two years that are particularly interesting to the statistician.

The volume of building and engineering contracts reached their all-time peak in May, 1928. From that month to February, 1929, contract volume declined 44 per cent, a decline of much more than seasonal magnitude. That low month, February, was just the time the Federal Reserve Board set out to curb stock market speculation. To most competent observers of business trends it seemed likely that the necessary correction of the financial situation might be made within a short period of time and without a violent financial shake-up. Construction contracts in the first quarter of 1929 fell 13½ per cent below the corresponding quarter of 1928; the second quarter was

only 10 per cent behind the second quarter of 1928, which had been the largest quarter on record. But interest rates kept on mounting and money for construction purposes was to be had only in more and more restricted volume. Contracts fell again in September and October. In October, when the stock market break finally came, contracts had been declining for 17 months, and the contracts for that particular month were 32½ per cent below the peak month, May, 1928. The stock break finally came several months after the downward turn of general business activity, of interest rates, and after the upward turn of bond prices. Of the important financial and economic adjustments that had to be made, deflation of stock prices came last and not first.

In most of 1929 money and credit were available in sufficient volume to keep business and the stock market going at record-breaking rates, but apparently not sufficient to keep construction activity going at a satisfactory rate at the same time. Many of us counted on certain factors of apparent stability to effect necessary readjustments easily. But we should carry this lesson away from the experience of 1929, a lesson that we seem to have to learn over and over again; in the midst of money uncertainty, two things seem to work with unfailing regularity: When long-term interest rates rise and bond prices and volume of new bond issues fall over an extended period, look for a decline in construction activity; when construction contracts decline over an extended period, look for recessions in general business and the stock market. Construction occupies such a key position in our economic structure that it seems reasonable to say that any prolonged construction decline tends toward business stagnation.

In view of this country's continuous increase of population and wealth, there is little room for doubt that a program of growth is in the making, and that it must be inaugurated by a program of increased construction activity. If prosperity is to continue at something near the levels of the past five years, it seems necessary that a proper proportion of national income must continue to be spent for building and engineering work. Since the country's greatest construction need at the present time is for public improvements of every kind, it seems proper that a program of public building and public works should be undertaken in 1930, and in seems reasonable to believe that the coming year will prove to be one of recovery and resumption of the country's expansion program after the rather serious interruption of the year just closed.

CREDIT DEVELOPMENTS IN 1929

By E. A. Goldenweiser

There is no relationship between the course of the earth around the sun and financial developments, and for that reason I find it difficult to speak about a year as a unit which measures important changes in financial history or one that comprises a complete cycle of progress. The present year is no exception; 1929 was not a unit; the first part of the year witnessed the end of a period that began much earlier, and the last part ushered in the beginning of a new cycle. The year may be divided into two parts of unequal length. The first ten months were characterized by a continuation of very rapid growth of security loans, by rising money rates and a continued firm credit policy by the Federal reserve system, while the last two months were characterized by a great liquidation of security loans; falling interest rates, and easier credit policy. The developments of the first ten months of this year were in continuation of conditions that in the money market and in credit policy had lasted for about two years. During those two years rising security prices and a continuous growth of credit used for financing security transactions had the effect of making money constantly dearer and of making it incumbent upon the Federal reserve system to use its influence towards firm money in order to check the growth of credit in that direction.

Federal reserve influence began to be exerted in the direction of firm money in November, 1927, and continued in the same general direction for practically two years. The policy expressed itself at first through gold exports that were not compensated; and later through the sale of securities. Both of these movements took money out of the market and caused member banks to increase their indebtedness and to be less well disposed toward borrowers. In addition to that the Federal reserve system advanced discount rates at various periods, so that the rates, which had been on a 3½ per cent level throughout the country in the last part of 1927, had advanced to a 5 per cent level by the early months of 1929. The system also advanced its buying rates for acceptances. In 1929 the Federal Reserve Board and the reserve banks went further by reminding member banks of the impropriety of increasing their security loans while at the same time being continuously and heavily in debt at the Federal reserve banks.

These actions of the Federal reserve system were directed toward checking the growth of credit in the security market, and the effective-

ness of the policy pursued by the system as far as banking is concerned is indicated by the fact that between May, 1928, and May, 1929, there was no growth in member bank credit. It was a year of active business and of an extremely active stock market, of steady prices, and of general prosperity, but bank credit remained at about the same level as a year earlier. There was, to be sure, a growth in some kinds of bank credit; security loans and all other loans were somewhat larger, but there was a corresponding liquidation in investments. The demand for funds by the security market, however, was so insistent that it drew a supply of funds from sources other than banks, and the growth of so-called brokers' loans continued to be rapid.

A word about the effect of these high money rates on the situation in the United States. Business in general did not suffer from the high money rates; mainly because large business did not pay them. It was possible for large business to issue securities on favorable terms and thus to obtain money at cheaper rates than usual. The business which was most inconvenienced by the high money rates, outside of small business, which was not able to finance itself by the issue of securities, was the building industry, which is usually financed through bonds. The bond market was most affected by the high money rates and by the competing attractiveness of brokers' loans.

Abroad, the high money rates in this country were having an extremely bad effect. The countries of Europe, which had recently come back to the gold standard and were struggling to rehabilitate their industries, found it increasingly difficult to protect their reserves against the attractiveness of our high money rates and of our security market. As a consequence, there was a return flow of gold amounting to about $250,000,000 in the first ten months of 1929 and a consequent necessity on the part of central banks throughout the world to protect their reserves by raising discount rates. Advances of discount rates were reflected in advances of rates to trade and industry, and it was a hard struggle for Europe against severe recessions caused by our high money rates.

In this short talk I can only sketch some of the outstanding facts. I wish now to arrest your attention for just a minute on the extent of the change in the picture that took place about the last week in October when the stock market crash occurred. So far as statistics can be dramatic, I think it is a dramatic thing that the borrowings of brokers from all sources as they are reported to the stock exchange in New York had increased from $3,500,000,000 on February 1, 1926, to $8,500,000,000 on October 1, 1929, a growth of $5,000,000,000 in forty-four months. In the following two months that figure was

reduced by $4,500,000,000, almost back to where it was in 1926. The change in reality occurred in not much over a month, during which there was wiped out the growth of the preceding forty-four months.

This decline in security loans, which was the result of a decline in security prices, changed the entire banking and credit situation in this country practically over night, and the developments since that time have been entirely different. Liquidation at first was in loans by those lenders who were not banks and had no particular responsibility for the use of the funds put into the market; these lenders were the first to withdraw funds and the banks had to step in and take over the loans. Later, as the liquidation proceeded further, the banks' own loans were reduced: First, the loans in the banks in New York, which were receiving a flow of margin funds and of new money for investment at lower levels of prices; later the monetary ease began to spread throughout the country, and by the end of December there was a liquidation in the banking situation practically everywhere in the United States. At the end of the year, as near as we can get it at this time, bank credit is larger than it has ever been, except temporarily during the first weeks of the liquidation, but it represents a much larger proportion of the combined amount of credit in use, whether from banks or from others, and the credit situation is greatly improved by the reduction in the enormous super-structure of brokers' loans for account of non-banking lenders.

Federal reserve policy since the latter part of October has been one of gradual ease. It has reduced discount rates to a 4½ per cent level at five of the reserve banks. In addition the Federal reserve banks have bought securities. Reserve bank credit outstanding at the end of 1929 is about $150,000,000 smaller than a year ago, this reduction representing the net addition of gold to the country. I want to emphasize at this point particularly the decline in that part of the total volume of reserve bank credit which makes for reluctance on the part of member banks to grant credit freely. Discounts of member banks, their indebtedness to the reserve banks, have gone down by $300,000,000, while Government security holdings of the reserve banks have gone up. The Federal reserve situation is, therefore, easier than the decline in the total volume would indicate, because the restraining part of Federal reserve credit has gone down from $1,100,000,000 to about $800,000,000, and this at the end of the year when the figure is usually at its peak.

A further word about the gold situation. During the first part of the year there was a flow of gold into the United States amounting to about $250,000,000 in ten months. The effect of that gold flow I have briefly mentioned before. After the decline in our money rates the movement

was reversed, and during the last month or two there has been an export of gold amounting to about $100,000,000. The foreign countries have been able, in addition to obtaining this gold, promptly to reduce their discount rates. The Bank of England reduced its discount rate from 6½ to 6 per cent on October 31, to 5½ per cent on November 21, and to 5 per cent on December 12. It made those three reductions in the course of about six weeks. Practically all the central banks in the world have reduced their discount rates correspondingly and rates paid by trade and industry have also declined. The world is greatly relieved, because the constant demand for funds from our security market, which was handicapping all phases of business and credit throughout the world, has subsided and they now have the opportunity to adjust their rates to their domestic situations, which on the whole call for encouragement rather than for restraint.

I feel that we are entering the year 1930 under more favorable credit conditions than we have had for at least two years, and while there are many phases of the situation that need to be watched and much that might develop that will not be so favorable, I think I can on the whole view the future in an optimistic light.

A HASTY ESTIMATE OF THE NATIONAL INCOME IN 1929

By Willford I. King

To estimate the total income of the people of the United States with a fair degree of accuracy is a very laborious and time-consuming task. Many thousands of separate items must be looked up for each year. Tens of thousands of computations are required before these separate items are knitted together into the single figure representing the national total.

If this one figure were the only outcome, the great amount of effort involved in its computation could scarcely be justified. The fact is, however, that hundreds of the sub-totals derived in the process of computation are in themselves important, many of them doubtless being just as useful as the grand total, since these minor totals satisfy the needs of persons having a wide variety of interests.

The National Bureau of Economic Research is just publishing a report entitled *The National Income and Its Purchasing Power*. Although this book appears at the close of 1929, the time-consuming nature of the process of computation and the lateness of the appearance of some of the basic data have prevented the final estimates of many items from being brought close to the present time; in fact, the more dependable estimates of the national totals do not extend beyond 1925. There is, however, a strong demand for approximations more nearly up-to-date. The Bureau has endeavored to satisfy this demand by publishing preliminary totals for the years 1926, 1927, and 1928.

Two methods of making such preliminary estimates at once suggest themselves to the statistician. The first is to find some criterion, such as bank clearings (or debits to individual accounts), which fluctuates in much the same way as income. It might, of course, be necessary to subject this barometer to mathematical treatment in order to modify its trend, its cyclical fluctuations, or both. Furthermore, in order to construct a satisfactory index, it might prove essential to combine a considerable number of such mathematically treated barometers. The present writer has not tried to forecast the national income by this method. The reason why he has not attempted it, however, is not that he believes it cannot be accomplished, but rather that he feels that this method fails to yield the sub-totals which constitute such an important part of the estimates.

The second method of attacking the problem is to make individual estimates for those constituent items for which up-to-date figures are

available. The assumption is next made that the changes in the variables for which data are readily obtainable have typified the movements of all the items in the field of which they are parts. The various segments of the income estimate are, therefore, varied in accordance with the movements of the supposedly typical items. It is in this manner that the totals for 1926, 1927, and 1928 have been prepared. In many of the fields, data for the first two of these years are practically complete. For 1928, more figures are missing, but several important fields have the majority of items covered. Clearly, then, the reliability of the calculated totals diminishes steadily as we push forward in time from the basic estimates of 1925.

To make an estimate of the national income for 1929 requires that one advance into territory in which the footing is even more shaky. Items corresponding to those used for the 1928 estimate will, in many cases, not be available until the spring of 1930. Only those variables for which figures are published monthly can be utilized in a computation made at the close of December. Most of these monthly figures have not been published for periods later than October. The 1929 estimate must, then, be based upon the reports for the first ten months of the year. These limitations should be kept firmly in mind when referring to the percentages which follow.

On the basis of computations applied by my assistant, Miss Lillian C. Epstein, to such figures as are now available, it appears that the changes from 1928 in various important categories making up the entire realized income of the people of the United States have been somewhat as follows:

PERCENTAGE CHANGE FROM 1928 TO 1929

Total wages and salaries paid		+ 3
Construction	−10	
Manufacturing	+ 7	
Railways	+ 3	
Agriculture	+ 1	
Other industries	+ 2	
Realized income of farmers		+ 2
Receipts from dividends		+15
Other income commonly reported to income-tax authorities		+10
Other income not reported to income tax authorities		+ 6
Entire realized income — Current dollars		+ 5
Entire realized income — 1913 dollars		+ 9
Per capita realized income — Current dollars		+ 4
Per capita realized income — 1913 dollars		+ 8

That the percentages of increase are apparently greater for income measured in 1913 dollars than for income measured in current dollars

arises mainly from the fact that house rents have fallen during the year, thus bringing downward, to a certain extent, the index used as a deflator. One must remember, however, that this deflating index is also preliminary and may be changed materially when fuller data become available.

SECURITY PRICES

By James F. Hughes

The subject assigned me was rather a simple one, a review of the movement of security prices during 1929.

In case there is anybody here who is not familiar with the facts, bond prices continued the downward trend which started in January, 1928. On the Dow-Jones average of 40 bonds, the low for the year was made on October 5. Since that time, despite the terrific crash in stock prices late in October and early in November, bond prices have held their October 5th low and have gradually, during December, picked up to about the average level of the middle of May.

Stock prices, as represented by the Dow-Jones daily averages, fluctuated throughout the first five months of the year in a relatively narrow 35 point trading range. During these five months occurred the great debate regarding the question whether speculation in stocks was consuming more than its fair share of the Nation's credit. This debate has had two decisions regarding the merits of the opposing arguments. The immediate decision appeared to be that too much credit was not being consumed because from the end of May the Dow-Jones averages advanced 90 points in three months and brokers' loans increased a billion and a half. Then there came a reversal of the first decision. From early September in ten weeks' time, the averages dropped 186 points. That represented a decline of 48½ per cent from the top price of September 3. This compares with a loss of 45 per cent in 10 months during the bad bear market of 1907. In the great deflation following the War these same averages lost 46½ per cent in 21 months.

To bring the record up-to-date, after reaching the low point on November 13 the market recovered approximately 40 per cent of the entire amount lost during the decline. It lost 186 points in the crash and it recovered 72 points to December 9. Since then we have lost about one-half of this intermediate recovery.

Getting autobiographical, I have done considerable work on the relationship of interest rates to the stock market. I have used various forms of interest rates and various combinations of interest rates with other things, such as average yields, to get an automatic device which would indicate the major trends of the market. However, juggling the figures as I might, I never could get an indicator which would be correct much better than seven-eighths of the time. For example, over the past 40 years during seven-eighths of the months included in bull markets,

commercial paper rates were under 5 per cent, while in bear markets seven-eighths of the months saw commercial paper rates above 5 per cent.

However, I was always rather uneasy about these periods, representing one-eighth of the time, during which the market ran counter to the current indictions of money rates. I used to say that when your fundamental indicators go astray then you must get your clues from the action of the market itself. I felt that after providing for seven-eighths of the time it was a rather generous gesture on my part to allow the market to indicate its own course during the remaining eighth of the time.

Of course, in 1928 when interest rates began to increase and get seriously high the market ignored them not only for several months, but continued to do so all through the year and into 1929. It became obvious that here was the opportunity to test the method of getting your inspiration regarding the course of the market from the action of the market itself.

I did considerable work on that method during 1928 and have been doing more all through 1929. I call this method the pacifist's approach to the stock market. I call it this for two reasons: First, you do not fight the market itself, and secondly, you do not fight over the interpretations of such fundamentals as the credit situation and business conditions.

I have not sufficient time to go into the infinite details of this method, although they are fundamentally very simple. It is based primarily on past experience with market action. In general, the market may be summed up with the statement that past experience has shown that a definite type of market action will usually be followed by a movement of the market in a definite direction. It is really basing a guess of the future of the market on definite past market action, regarding which past action there can be no dispute.

I want to illustrate the practical utility of this method from the experience of the past eight months, from the middle of April through December. On the basis of past performances alone, stocks were a buy about the middle of April. On May 4 they were a sale, or at least a partial sale on the basis of something that had occurred within the market. By the 13th of May they were a definite sale, and if sold, the major portion of the May break would have been avoided. On June 1 they were a definite buy. From June 1 there was no definite selling indication until early in August when the market provided a reason to sell stocks. That reason was the crash, totally unexpected, coming out of a clear sky, of the Insull utility stocks in Chicago. Such an unex-

pected crash always provides, from my point of view, a dependable technical indication to get out of stocks generally if the fundamental situation is at all doubtful. Of course, this particular indication provided a lucky break because it enabled anybody selling to avoid the break which followed the increase in the New York Reserve Bank rate. Also, on the basis of an old speculative maxim that, if stocks are sold for one reason and they actually go down for another, one's position should be reversed; stocks were a purchase after the break brought about by the increase in the rediscount rate.

The vigorous rally which followed that one day of sharp decline, while providing no basis for definite market action, at least provided along late in the month some reason for being cautious.

A great deal could be said about the technical action of the market in September. However, there was no definite indication to sell based on the action of the market alone, until the latter part of the month. However, by the 20th of September it was plainly evident that something was wrong with the market. Without going into details, the most important fact was that the September reaction was radically different from all technical breaks of the past few years.

Before concluding I want to call attention in somewhat more detail to one important division of technical market action, the climactic break, followed by an automatic rally. The climactic break is one which runs from two to four days. It starts rather slowly, like an avalanche, and gathers increased momentum both in acceleration of price decline and volume of trading. After from two to four days of increasingly heavy selling the climax of the decline is reached. The market then executes an abrupt about-face and retraces, usually within two days, approximately 50 per cent of the ground lost during the immediately preceding crash.

This tendency toward the automatic rally was repeatedly in evidence in the technical breaks which occurred during the bull market of recent years. The great collapse in prices during October and November provided a severe test of this particular technical factor. The results proved its absolute reliability regardless of fundamental prevailing trend. During the most chaotic market in our history, from the middle of October to the middle of November there were five indications of temporary climax to the panicky selling. In each case a rally followed promptly. In four cases the automatic rally ran well over 50 per cent of the immediately preceding decline. In one, however, the recovery amounted only to 46 per cent.

I have called the October-November decline the most chaotic market in our history. But from the point of view of quick, automatic response

to technical indications a case might be made for this period as the most docilely obedient of all markets. For one month it was possible to catch every turn in the market by buying on the indications that a climax was near, selling as soon as a 50 per cent recovery had been approximated, and waiting for the next wave of selling to run its course and provide the next climax. The rules for operating were far simpler and more definite than those applying to a so-called normal market.

I present this material for one reason. I think the experience of the past two years indicates that it is possible for people to be very much at sea regarding the so-called fundamental factors and their application to the stock market. I believe that the systematic study of technical market action offers greater possibilities of a practical understanding of the stock market than does ambitious research into the so-called fundamentals. Technical action provides the methods of definitely timing the important turns in the market, something that the fundamentals can do only with the allowance for a very wide margin of error.

CORPORATE EARNINGS AND STOCK PRICES

By Robert C. Effinger

The present study summarizes 31 individual studies of the relationship between the earnings of individual corporations and the highest prices recorded each year for their shares in the seven year period from 1922 to 1929. It was undertaken to throw light on the character of the advance that until recently had been causing such a sustained demand for credit with which to buy stocks, in the belief that the movement of stock prices was playing a dominant part in the determination of interest rates.

The companies whose earnings and share prices were considered included 21 well-known industrial corporations, 5 representative railways, 2 large copper companies, 2 telephone and telegraph companies and 1 bank.

The basis of selection was inquiries from bank customers, the satisfaction of which necessitated some of the calculations required.

Adjustments were made in both per share earnings and prices for all stock dividends, the splitting up of shares and rights issued, such that fair comparisons could be made between present prices and earnings, and those reported in former years.

The justification for presenting averages instead of the data for individual companies lies in the fact that with a few exceptions there was a pronounced degree of uniformity in the cases considered, namely, a tendency for stock prices to reflect a capitalization of earnings at progressively lower rates after 1926.

The first step was to find the geometric mean of the per share earnings of the 31 corporations and the secular trend for these, expressed as a straight line determined by the method of least squares.

	1922	*1923*	*1924*	*1925*	*1926*	*1927*	*1928*	*1929*	
Earnings ($).....	2.37	3.85	4.06	5.19	5.78	4.95	6.15	7.79	(Est.)
Trend ($).....	2.99	3.53	4.08	4.62	5.17	5.71	6.26	6.80	

The second step was to find the geometric mean of the highest prices recorded in each year for the stocks of these same corporations, and compare these with the per share earnings trend capitalized at 10, 9, 8, 7, 6 and 5 per cent. From 1922 through 1926 it was found that the highest prices recorded each year for these stocks fluctuated around the earnings trend capitalized at 8 per cent, or 12.5 times the earnings trend. After 1926, however, prices moved sharply upward and away from the

earnings trend capitalized at 8 per cent to a point in 1929 above the earnings trend capitalized at 5 per cent, or more than 20 times the earnings trend. See Chart No. 1.

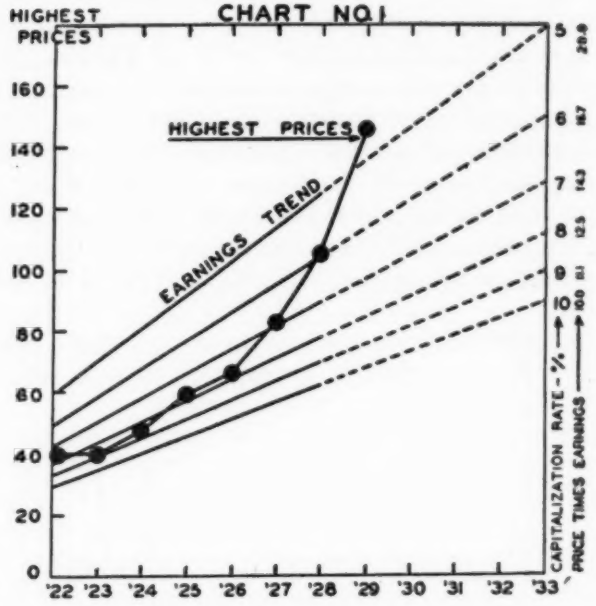
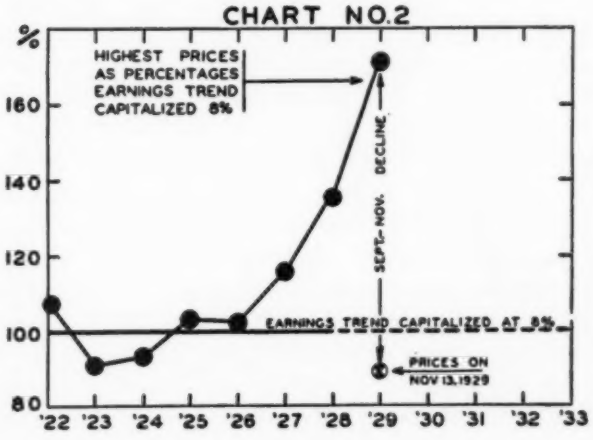


Chart No. 2 more clearly shows the relationship between the highest prices recorded each year and the earnings trend capitalized at 8 per cent, as well as the relationship between the earnings trend line capitalized at that rate and November 13, 1929, prices.



These data clearly indicate that for the 31 companies considered, the advance that took place in the average price of their shares in 1927, 1928 and 1929 was not based on corresponding increases in their average earnings. Other factors were evidently responsible for what occurred. Of those that might be mentioned, one of the most important was the ability of would be borrowers against stock collateral to secure credit, reflected in the steady rise of collaterally secured loans made by banks.

With the Federal Reserve Banks' holdings of gold what they are, and what they are likely to continue to be for a time, together with the continued presence of some of the other more important factors responsible for the 1927–1929 rise, it is conceivable that within the next few years, another sustained advance in prices may occur that also cannot be explained by any corresponding increase in earnings.

THE RÔLE OF INVESTMENT COMPANIES IN THE SECURITY MARKETS OF 1929

By Leland Rex Robinson

The subject assigned to me is "The Rôle of the Investment Trusts in the Security Markets of 1929," but in view of the fact that investment trusts, in the technically correct sense, are but one group in that large class of financial companies comprising holding, trading, finance and investment companies, it would not be feasible to limit our attention solely to the former. Moreover, it is difficult to deal in broad affirmations without obscuring many different factors, some of them conflicting, which enter into the problem.

Were such companies, including investment trusts, the cause rather than the result, the creators rather than the creatures of the recent bull markets? If they directly stimulated the unprecedented demand for stocks, of which they also took advantage through large issues of their own securities, it is natural to blame them, at least in part, for the crash. If, on the other hand, they were rather the result than the cause of the pre-crash markets, very different conclusions must be reached.

There is little evidence for supposing that they were the cause of these markets. That they took full advantage of highly favorable conditions for the issuance of common stocks is a matter of record, as is also the fact that they were growing enormously in popularity in the months immediately preceding the break. Moreover, the advertising and publicity conducted by some of them in favor of common stock buying, and in explanation of their own investment policies, added to the widespread popular interest in equities.

However, the fundamental explanations for the late unprecedented stock markets go far more deeply, and it is not within the scope of this paper to deal with them. Emphasis for several years upon the qualities of common stocks for long-term investment; the increased volume of business and larger earnings of leading corporations; the preaching of the "new economic era" with its promise of greater steadiness and better coördination in the vast network of the nation's industries; the ample supply of gold and the country's comfortable reserve position; the growth in investment capital coupled with a widespread interest in and knowledge of the characteristics of junior as compared with senior securities—all these and many other factors have to be reckoned with as basic causes, without losing sight of the mob psychology which in the later stages of the recent bull markets broke past all barriers of reason.

It is, therefore, altogether reasonable to assume that financial companies were rather the result than the cause of the extremely buoyant stock markets of the last few years. To carry further the analysis, let us trace out the effects upon the markets for American stocks of the two different ways in which the capital funds of these companies would normally be employed, namely, in the purchase of securities, and in call loans.

There was undoubtedly a greater disposition to invest freely in the first than in the second half of 1929. While finance, holding and investment companies are by no means the principal factor in the call loan market, it is significant that the total volume of brokers' loans, demand and time, as recorded both by New York City reporting member banks and the New York Stock Exchange, was relatively stable during the first five months of 1929 as compared with 1928 or with the latter half of 1929, when in the four months preceding October 1 each of the aggregate figures increased by more than a billion and a half. Taking up, first, the effects of their investment buying, or their trading activities upon the markets for American stocks, we perceive that broad generalizations are likely to prove more misleading than helpful.

Some companies, for instance, have taken out of the market blocks of securities bought in accordance with fixed investment policies, or for purposes of influence or control. The effect of this has been to stimulate prices of the stocks bought, or at least to steady them by removing indefinitely a part of the floating supply. Other companies have exercised great discrimination in their stock purchases, and have been largely out of the market and in a liquid position at various times during the last two years, especially prior to the recent breaks. Moreover, many companies, including several pioneers in the American investment trust field, are interested in foreign as well as domestic issues, in bonds as well as stocks, and in a wide inter-industrial distribution of risk. Constant investment supervision has involved sales in buoyant markets and purchases in markets "out of line." Their activities have exerted a steadying influence upon security markets.

It has been earlier noted that in the four months preceding October 1, 1929, brokers' loans increased by substantially more than a billion and a half dollars. What exact proportion of the aggregate brokers' loans, or of this dramatic increase, came from recently organized financial companies we have no way of determining until the figures are given in greater detail as to sources—a most desirable elaboration.

However, in view of the fact that the total paid-in capital of such companies could hardly have exceeded half the amount of these loans, while their entire funds on call have been variously estimated at from

one-fifteenth to one-sixth of the brokers' loan total, is not the relative importance of such companies in the call loan market exaggerated? Two outstanding factors should not be forgotten: That business corporations, anticipating their future needs, raised large sums through further stock issues, and employed this capital in part under the highly favorable conditions in the call loan market; and that for months preceding the great crash the principal bourses of Europe rested under the cloud of tight money artificially created by the omnivorous appetite of Wall Street.

To the extent that financial companies employed their capital in call loans, they were really making available again to the public for security purchases, at very high interest rates, the money which had earlier been paid by the public for their own shares (on which a proportionately small percentage of cash return, if any at all, was being paid). Because these companies for the most part were cautious in their own purchases prior to the recent crashes, they were acting in some measure as a break upon the extravagances of the bull markets. In effect they diverted into their own coffers large amounts of capital which might otherwise have gone directly into further swelling of speculators' profits by purchases of popular stocks at inflated prices.

In considering the causes of the series of stock price crashes we must distinguish between the immediate and the fundamental. It is significant that the news of the Hatry failures was out on September 20, 1929, just one day after the high point in stock prices was recorded on the *New York Times* industrial averages. Dr. Rufus S. Tucker has called my attention to the fact that immediately after this event the exchange rates of the pound sterling, German mark, Belgian franc, and Dutch florin rose rapidly to points well above par, despite the unseasonable character of this movement. This reflected a rapid withdrawal of funds invested here on foreign account in call loans, acceptances and securities. The general decline in European stocks, which had been proceeding for several months, was partly due to the heavy drain toward Wall Street. It is only natural that unsettled conditions following the Hatry failure, and the rise of discount rates at the Bank of England and other European central banks in the last week of September, should have started American prices definitely on the downward course by causing large withdrawals of foreign capital. These early foreign withdrawals were met in part by loans from newly organized financial companies, figuring in the loans "for others" accounts reported by the banks.

In the almost perpendicular decline that materialized in brokers' loans, withdrawals "for others" approximated two billion dollars, and

the reduction of loans made on behalf of out-of-town banks, while less than a billion and a fifth, was even greater in proportion. At first the New York City member banks, with the help of the Federal Reserve, made additional loans for their own account in an amount approximating a billion dollars. After a week or two, however, liquidation had set in so rapidly that these member banks were in turn speedily decreasing brokers' loans for their own account; and within a month such loans were below their earlier total. During the critical week when New York member banks increased their own loans by about a billion dollars, there was withdrawn from brokers' loans approximately $1,350,000 on account of others, and $650,000,000 for out-of-town banks, the latter withdrawal being greater in proportion.

To recapitulate: Heavy foreign withdrawals of capital from American markets reduced the funds immediately available for stock speculation; and the sale of foreign-owned American stocks increased the floating supply on the market. These two factors helped to undermine further the highly unbalanced security price structure in this country and to start the processes of acute demoralization. However, there is no reason for assuming that the crashes of October 24, 28 and 29, and November 13, and the periods of acute weakness between and following them were due to the heavy withdrawals of funds from brokers' loans. If this were the case, rates on money, both call and time, as well as on bankers' acceptances, would not have weakened so perceptibly prior to the first panic break, nor would these rates, as well as those on commercial loans, have remained so comparatively low ever since. We have already noted how the New York City member banks came to the rescue during that critical period when reductions in brokers' loans were due to withdrawals on foreign account, on account of out-of-town banks, and on account of lenders figuring in the loans "for others," rather than to the transfer of stocks from weak hands to strong ones, or from speculative accounts to genuine investors. From that point onward the decrease in brokers' loans was the inevitable result of long overdue liquidation processes. This change of ownership from marginal borrowers who had bought at high prices to bargain-hunting investors using their own capital was due to the crumbling of public confidence in the existing price structure and to the forced sales resulting therefrom, rather than to any acute money shortage, real or fancied.

One further point is worth emphasizing. Withdrawals from brokers' loans on foreign account meant an actual reduction of that much capital used in the American stock markets; withdrawals by out-of-town banks meant in general a diversion of funds from securities to business purposes; whereas reductions in brokers' loans due to with-

drawals by financial companies were soon largely compensated for by their purchases of undervalued securities.

It is true that a vast volume of financial company flotations added to the oversold and undigested condition of the market in September. However, all such issues, including a wide diversity of incompatible types, did not exceed 26 per cent of aggregate new flotations in the first ten months of 1929, or 34 per cent of the total from September 1 to mid-October. Much capital going into these companies would otherwise have been employed in the first instance to purchase public utility and industrial issues already selling at equally or even more inflated prices. In short, money was to a certain extent diverted from additional purchases of active older stocks into new financial companies, which loaned these funds on call instead of further bidding up prices by their own purchases in a topheavy market situation.

As unreasonable as the claim that these companies caused the crash is the complaint, equally in evidence at the time, that they did not counteract it. It might in all fairness be asked how they could have done either—since they could not possibly have done both—with an aggregate capital equivalent to less than one-twentieth of the total value of stocks listed on the New York Stock Exchange alone at the height of the market.

There is, in effect, no valid reason for maintaining that financial companies as a group were responsible for the preceding inflation, or the subsequent crashes. Some among them did add their influence to the cumulative forces which brought the price structure into such an unbalanced position. Others, including many of the investment trusts in the proper sense of this term, acted in the interests of sanity and conservatism by the careful selection and pricing of securities.

BROKERS' LOANS AND THE PYRAMIDING OF CREDIT

By Carl Snyder

From a rather extended review of the evidence, I have gained the impression that 1929 may long remain as one of the extraordinary years in our financial history. Much of this evidence suggests that it represented the most extreme outbreak of speculative mania, certainly of the last fifty or sixty years. One of its curious features was the prodigious rise in brokers' loans and the novel process by which they were carried to unheard of heights. The story, in brief, is this:

Before the War it was currently estimated in the banks that at the peak brokers' borrowings might reach a billion dollars; but this was merely an estimate. The total may have risen considerably higher with the remarkable rise of industrial stock prices in the war boom of 1916. But it was not until 1918 that we began to have definite knowledge.

At the end of that year, New York Stock Exchange borrowings were reported as close to one billion dollars; in the short-lived boom of 1919 they rose to nearly 1800 million, dropping back again in the collapse that followed to below a billion, in 1921.

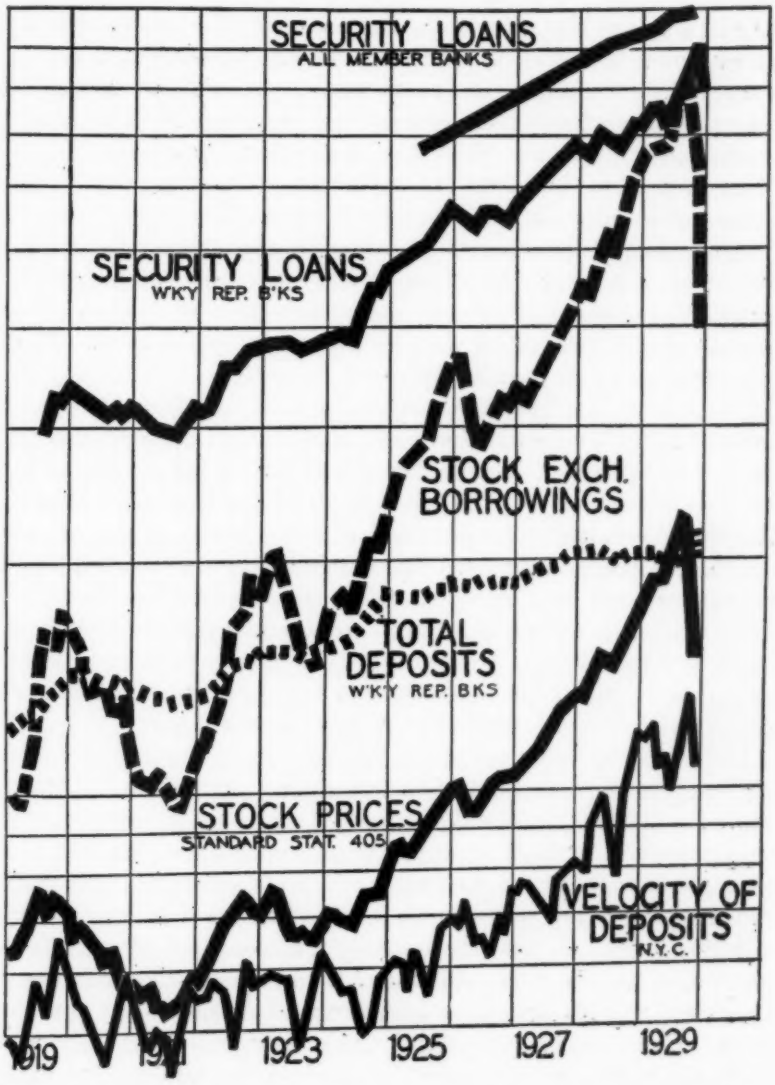
In the sharp advance in 1923 the Standard Statistics' broad averages of stock prices did not quite reach the peak of '19, but brokers' loans were a little higher, over 2 billions. They were less than 1½ billion at the end of the year.

Then began the most spectacular increase, undoubtedly, in stock market history, probably anywhere in the world. By the end of 1925 total Exchange borrowings were 3½ billions. At the end of '27 they were nearly 4½, and at the peak of '29, more than 8½. It is of interest now to recall that there was a wide number of well informed persons who found in this enormous increase nothing seriously abnormal or fantastic, or foreboding disaster.

Then, as we know, came what appears to have been the most violent crash in the history of the Exchange; in a space of six weeks more than half of this vast total of brokers' credit had been extinguished. The extraordinary thing was that this enormous increase, and collapse, was accompanied by no corresponding degree of inflation of bank loans on stocks and bonds, nor, in a sense, in the total of bank credit outstanding.

In the five years from the end of 1924, while brokers' loans rose four and one-half times, or by 6½ billions, security loans in the weekly re-

porting banks increased by only about two-thirds. The final increase in collateral loans, of over a billion, after the panic had started, was largely an emergency issue, to cover the withdrawals of loans "for the account of others," and for non-reporting banks and houses.



While in the last phase brokers' borrowings were rising at more than a hundred per cent a year, total bank credit was increasing at only 5 or 6 per cent, and latterly, in the twelve months preceding the panic, this

increase had fallen to zero. How could such an extraordinary conversion of existing credit take place?

In this period, undoubtedly there was an excess of credit, beyond the estimated requirements of business, for without such an excess speculation cannot thrive. In the last four years the increase in the total of the Nation's product, and trade, has not, despite persistent illusion to the contrary, increased at more than about the computed normal or average of the last fifteen or twenty years. In 1927 and '28 the rate of increase was distinctly *below* this normal or average. Few myths had less foundation than the widespread belief in a "new era."

Experience has shown that an expansion of credit in excess of the requirements of trade almost invariably brings a period of speculation and some form of inflation, with the usual attendant outpour of a heavy volume of new securities. Though these latter are often largely the product of mergers and consolidations, this financial activity seems to produce the illusion of an unusual expansion in industry. The last four years we know were no exception.

Finding markets propitious to the issue of new securities, corporations of all kinds were not slow to take advantage of them, and, taking time by the forelock, to issue bonds and stocks far beyond their immediate requirements. This heavy outpour was swollen by the further issue of the investment trusts, tending to create an artificial or unusual demand for common stocks. The excess of funds so created found an outlet in the call loan markets, and as the speculative furor grew and brokers' interest rates rose accordingly, the attraction for funds correspondingly increased. Apparently new issues were in large part paid for by loans derived from previous new issues, or from the sale of other stocks which, in turn, were bought on borrowed money.

Apparently what happened was that first one corporation would issue stocks or bonds and, finding no immediate use for the funds, or attracted by the high rates in Wall Street, these would be loaned in the call money market, and other corporations would issue new securities in turn, and the money for the first would eventually and doubtless by a circuitous route furnish the funds for the flotation of the second; and so on without end. It was exactly as if John Jones had borrowed a thousand dollars at the bank and loaned it to his next-door neighbor who had passed it to his brother-in-law, who paid the real estate broker, and so on. Conceivably, out of this single thousand-dollar loan, a total borrowing of ten, twenty, or even a hundred thousand dollars might be built up.

And so, it would appear, did the speculative card house actually arise. In twelve or fifteen months preceding the panic, by this process

of turnover, with very little increase in the total of collateral loans by the banks, and practically no increase of total deposits in the banks either in New York City or throughout the country, total Stock Exchange borrowings increased by nearly 4 billions.

All this was accompanied, as usual, by a terrific churning of the market, in which four, five and six million share days came to be so frequent as to excite little comment. This naturally carried with it a corresponding increase in the volume of check transactions, and, since there was little or no increase in the deposits of the New York City banks, a staggering rise in the rate of turnover to what appears to have been the highest ever known.

It is somewhat curious and characteristic of the whole episode that this high rate of turnover, and the failure of New York City deposits to increase, should not have attracted more attention than it did. The Street was filled with ideas of a vast inpour of outside and foreign money, forgetful apparently that the whole amount of currency in circulation in the country, outside of the banks, is probably much less than 4 billions, and that, if outside and foreign money was pouring into Wall Street, in any such amount, New York deposits should show a corresponding increase.

Actually this increase was surprisingly small. This implied, then, either that there was a mechanism by which this vast inflow of funds should flow out again, week by week and month by month, which was hard to understand; or else that this balloon of brokers' credit was inflated by some such process as I have described.

Such an outflow would have meant that the whole country outside New York was selling securities in vast volume to Wall Street, which was clearly the reverse of the fact.

That, on the other hand, there was no such inflow is fairly evident from the course of the New York money market since the collapse. In the panic the New York banks expanded their loans by a billion and a quarter, in part, no doubt, to meet urgent new borrowings by holders of securities, and in part to meet the withdrawal of outside funds in New York. But these emergency loans have now been almost entirely extinguished and the total outflow that can be measured could probably at the most not exceed two or three hundred millions to date.

Meanwhile, 4½ billions of brokers' loans have faded into thin air with no corresponding change in the volume of security loans by the banks, nor in the deposits of the banks in New York City or elsewhere. It is quite an amazing story.

My knowledge of financial history is not exhaustive, but so far as I have been able to discover there appears to have been nothing quite

like it since the days of John Law and the Mississippi Bubble, and the South Sea Bubble in England. And apparently the process was almost identically the same. In the case of John Law he actually printed the money—this is literal and not fanciful—with which the securities he issued were bought. It appears that Law himself understood clearly what was happening and wished to hold the speculative fever within bounds by shutting off the supply of new notes. But the Regent would have none of this and apparently forced the further issue of notes until depreciation began, the public took alarm, and the card house fell.

With a slight change in the counters, much the same thing appears to have characterized the last phase of our most spectacular stock boom. Our Wall Street financiers seemed to see no limits to which the fiction of "new values" could be carried. What repercussion the collapse will have upon the industry and employment of the country remains to be seen.

THE STOCK MARKET PANIC IN 1929

By Irving Fisher

To my mind the problem of the stock market panic is, and will be to some extent for many years, an enigma, but I think now is the time to gather data and to make preliminary estimates of what really happened and why, because as we wait, those involved are forgetting; and if we wait too long the people whose memories are most important will have died. Some one has said that the "perspective" of the historian, about which the historian boasts so, is simply due to the fact that all those people who had the data, from which they could contradict him, are no longer living.

I shall probably modify my opinion from time to time in the future as I have in the past. But I wish now to gather together what evidence there may be on the most important economic event in the lifetime of all of us here.

Perhaps some of you who are more or less familiar with my work in statistics may not realize it, but this is the first time I have ever tried to analyze an historical event and to trace all the causes at work. I have never studied or written a paper on business cycles as such. I have merely tried to trace individual threads, such as the rate of interest or the change in the purchasing power of money. Yet, much to my amazement, I have been credited with having a theory of the whole phenomena.

I conceived it to be a proper function of the analyst to trace faithfully what would occur if one individual force was at work unhindered by others, and on that basis I have tried to show how changes in the purchasing power of money, for instance, have explained a great deal in the business cycles, but I have never tried to explain "the business cycle."

Now it is my desire to try to get all the elements together in my forthcoming book on the stock market crash. It is an exceedingly complicated problem. For this reason it would be impossible to present all aspects at one short meeting like this.

I wish this preliminary explanation to be made and emphasized in order that you may not think that by picking out a few outstanding factors I am pretending to represent a complete view of the subject. To do so must, of course, over-simplify the problem. No problem as complex as that before us now can be expressed in two or three outstanding influences.

Nevertheless, if I were to try to pick out those influences which seem to me most important, they would be somewhat as follows:

The stock market crash had its roots primarily in the bull movement. If we want to explain the crash, we must explain the bull movement that preceded it.

As I see it, this bull movement was justified to a very large degree. Last night I was talking with a fellow student of this problem, whose judgment seems to me as good as anybody's, and who stated that, in his opinion, two-thirds of that spectacular 100 per cent rise in the stock market between 1926 and September, 1929, was justified by prospective earnings while the other third was due to unjustified speculation. I would concur in this conclusion as representing the composite of my own judgment, estimate or guess, whichever you choose to call it; although I would raise the figures a little and say that between two-thirds and three-fourths of the rise in the stock market between 1926 and September, 1929, was justified. The unjustified character of the remainder is best registered by the swelling of brokers' loans. This unjustified part was the outgrowth of the other part. It was just because there were great chances to make money such as have seldom if ever, in the aggregate, occurred before in the history of the world that so many people were eager to profit by them and went into debt for this purpose. They thereby erected a great credit structure beyond anything that had previously been erected.

On the face of it, it looks absurd to justify even two-thirds of the 100 per cent rise in the stock market. After this tremendous crash, it has become the fashion to decry the phrase "The New Era," which so many were using a few months ago. That phrase may perhaps be exaggerated in its implications, but I do believe that the Hoover Committee on Recent Economic Changes was right when it said that the "tempo" of invention and improvement in the arts was greater since the War than ever before, and I point out that even a slightly increased tempo is magnified in the equities of common stocks.

I think that what Mr. Snyder has pointed out is of very great interest—that the general rate of growth of production has been fairly constant for a long time. But we must not slur over the variations from the general trend.

I call attention to the particular line signifying the product per man. The product per man, according to Mr. Snyder's line, went up sharply in the last few years.

This has been due largely to inventions, and inventions have been due largely to the fact that invention for the first time in history has been making use of science where only a few large corporations had

been doing it before the War, and, after the example of Germany, almost all important corporations now have their development and research laboratories. One has four thousand scientists at work all the time to improve its products. We have mass production of invention, and it is shown in the lagging of the Patent Office. The war inflation led a great many college professors who were living on their salaries to discover that they could no longer do so because the purchasing power of the dollar had fallen. It was necessary for them to increase their incomes, and they accepted whatever opportunities came to them to go into industry, and industry found it was the most profitable investment ever made.

Besides this historical accident of inflated cost of living there was another. The same inflation had brought up wages. This was aided by a stoppage of immigration. When deflation came, organized labor was strong enough to resist recession of wages. Industry had to put up with high wages, and decided that it should save labor by labor-saving inventions.

So there was a great impulse toward labor-saving invention. Besides, those owners introduced industrial management as never before. The War pyramided trusts, and we have been condoning them ever since. We have been praising mass production and scientific management where before we criticised them. Labor has been coöperating as never before, especially under the leadership of William Green. These causes and the flight from bonds to stocks, especially after the publication of Edgar Smith's book on stocks and long term investments, and the coming of investment trusts that exploited that idea, have led to greater confidence in common stocks.

These are some of the reasons why there was a bull market, and a justified bull market. How did it happen that there was an unjustified expansion of loans? It would happen necessarily, I suppose, to some degree anyway because whenever there is a good thing to be exploited people become over-enthusiastic and swing to extremes. But aside from this, there were special reasons why there should be a going into debt. One reason was that during the War many people, who had never before known what investment was, were induced to buy Liberty Bonds and to do so on borrowed money, and when the Liberty Bonds were paid off, as they have been to a large extent, those funds were then seeking investment by the same process—borrowed money. The psychology had been set for investing in whatever seemed most profitable on borrowed money.

Then again, and this I think is of very considerable importance, the rate of interest ought to have been raised in sympathy with the big

investment opportunities. I have a book that is in the course of preparation on *The Theory of Interest* in which I have emphasized the importance of invention, and when new invention gives an opportunity to make more than the current rate of interest there is always a tendency to borrow at low rates to make a higher rate from the investment.

Now the rate of interest was artificially low, partly, because we had so much gold after the War and gold had a fictitious influence upon the rate, and then, a little later when Europe began to get back on the gold standard, we tried to help Europe by not re-attracting that gold to this country by raising the rate of interest. And finally, when the bull market came into being the Federal Reserve system not only still wished to prevent the exodus of gold back from Europe to the United States but also wanted to maintain the low rate of interest for what it considered legitimate business as distinct from speculation. It was confronted with the problem of how to discourage the speculation in Wall Street and at the same time not to discourage business by a too high rate of interest. It tried to make a discrimination, but it was like putting a log across half the stream. The water merely went around it. In so far as the banks coöperated with the Federal Reserve system, in not loaning in Wall Street, to that extent the "bootleg" lenders, came into the market and supplied the deficit.

I think, as we look back—and hindsight, of course, is always better than foresight—we may now say that it would have been wiser had the Federal Reserve system, in order to nip this speculation in the bud, raised the rate of re-discount indiscriminately over a year ago. It certainly would not have deterred business as much as the stock market crash, which was the fruit of the other policy.

In other words, the same mistake, in a different form, was committed as was committed in 1919 when in order to encourage business after the War there was an easy money policy. It then led to commodity inflation while this time it led to stock market inflation.

So, without trying to introduce any complications into this oversimple statement of the situation, I shall conclude that there was underlying this bull movement a justification in fundamental conditions, and on top of that justified bull movement there was an unjustified going into debt, encouraged by the fact that investors found themselves confronted on the one hand by wonderful opportunities to make money and, on the other, a low rate for loans. They could borrow at much less than they expected to make.

In short, both the bull movement and the crash are largely explained by the *unsound financing of sound prospects*.

FORECASTS FOR 1930

By Paul Clay

It seems to me that July is most likely to mark the bottom of this depression, and I have several reasons for this opinion. In the first place the average duration of business depressions in the past forty years, counting from the peak of the index numbers to the bottom has been fourteen months; and the peak was June. That would carry it into August; and August means July in this year because invariably trade improves in August or the latter part of July owing to the crop movement, owing to the placing of orders with industrial companies, owing to the return of business men from vacations, and to the general beginning of the autumn trade.

Then, there is the second reason for naming July as the bottom of the depression, namely that many of the important seasonal curves make their bottom in July. That is true of the curves of productive activity, of the curve of manufacture activity, and of the seasonal curve of wholesale and retail trading activity. Although a business depression or a boom may terminate in any season of the year, for this depression to terminate before the bottom of the seasonal curves would mean a better than seasonal result; and I see no reason whatever to expect better than seasonal result in view of the facts that the American people have just lost several billions of dollars in the stock market, and have to have time to recuperate and that it takes time to thaw out the frozen loans that are tied up in stock market losses.

There is still a third reason. Let us concede that this may be a minor business depression. I think it will, and I suppose that opinion is practically unanimous but, as a matter of fact, according to the movements of these index numbers the minor business depressions as a rule have had a longer duration than the major depressions. The major depressions have averaged about eleven or twelve months and the minors fourteen or fifteen months. So that, without arriving at a hard and fast forecast, I think that July is most likely to mark the bottom of the business depression.

However, the outlook seems to me excellent, and for a strong psychological reason, namely, that a primary boom is habitually followed by a secondary boom. We never hear of secondary booms, although we often hear of secondary reactions in the stock market. But the secondary boom in American economic history has become almost a habit; and by a "secondary boom" I mean one which follows a pri-

mary boom and which has no very broad economic basis. By a "primary boom" I mean one which does have a broad economic basis, such as great improvement in financial or industrial systems or methods.

Sometimes the secondary booms occur in the stock market only, and sometimes in both trade and the stock market. For example, after the primary boom which terminated in 1872 in the stock market, we had a secondary boom in 1874 accomplishing a recovery of 76 per cent. And after the primary boom which culminated in 1881 we had a secondary boom in 1882 in the stock market; and after the primary boom in both stocks and trade culminating in 1890, we had a secondary boom in both culminating in 1892. Likewise the boom of 1909 had a pretty poor economic basis. It was largely secondary to the boom which terminated in 1906. About the only great factor in the boom in 1919 was the big expansion of our foreign trade, based upon the fact that we were lending Europe money to pay for our goods; and I should call that boom secondary to the one of 1916. Thus it has become a habit to have these secondary booms; and that habit, in my opinion, has a very strong psychological basis.

"Normal" to the American business man means the content of memory. When we first ran into a rapid boom it was something new to the business man. It did not conform to the content of his memory; but after we have had a boom like in 1920 or 1906, then the content of his memory becomes a set of boom conditions, and these become "normal" for him. Thus I believe the word "normal" to the American business man today means boom conditions like those of 1928 and early 1929; and the sentiment of the mass of business men tends to create the expected.

And so it is that we have a pretty satisfactory outlook even though the bottom of the trade depression may not occur until July.

The chances are that the stock market will advance long before that. There is no exact definable relation, so far as I can see between the bottom of the stock market and the bottom in trade. But there is a habit of the stock market that bears on this present case, namely, that in the bear movements of the past fifty years as a rule the market has spent about fifty days around the lowest level, and about three months within 10 or 15 per cent of the bottom, and about six months within 10 to 20 per cent of the bottom—so that, allowing for normal duration at low levels, we ought to expect the beginning of a real bull movement in the market some time probably in March or April.

Therefore, I am in agreement with the consensus of opinion, except that it seems to me the depression is likely to drag into July. It seems to me also, that the coming "boom" is likely to be a period not of real

boom, but rather of plodding prosperity; that one can hardly forecast beyond the month of November, unless he can form an estimate of what the next Congress is going to be; and that, nevertheless, a boom between now and October is pretty sure to occur if we define it as a "secondary boom."

MEASURING INVESTMENT VALUES

By Malcolm C. Rorty

To one who has been absent rather continuously from the United States during the past five or six years, the trend of investment markets during the past year has exhibited a specially interesting combination of factors.

The prevailing idea seems to have been that American business, backed up by new sciences of political economy and of business management, and by an intensified technical research, was to progress henceforth, without pause or check, and with a constant increase in profits. We were warned that we must not "sell the United States short." We were told that we must consider only earnings and must pay no attention to physical values. We were looked upon as hopeless pessimists and conservatives when we suggested that some of the old economic laws still held force, that business depressions still were possible, and that competition in the long run would tend to make physical values some measure of possible profits. There had, in fact, developed a veritable cult of the common stock. Serious minded, not to say *too* serious minded, statisticians took the rapidly increasing earnings of those corporations which, for the time being, had leadership in their special fields, and projected such earnings at the same rate of increase for long periods into the future, without due regard in some cases to the natural limitations imposed upon the industry as a whole, or to the certainty that no one concern in a competitive field could maintain forever a wholly dominant position, or to the equal certainty that time and age in due course would inevitably dampen the fires of the most vigorous organization.

When these optimistic forecasts had once been made, the future, both as to distribution of earnings and as to market price of the stock, was discounted at a 6 or even a 5 per cent rate, in order to obtain the present-day value of the shares involved. If, then, we compared this rate of return on common stock investments with yields of 5 per cent, or better, on high grade bonds or guaranteed stocks, we were told that rises in price levels would largely, if not wholly, offset bond interest and that price inflation would surely take place, regardless of present declining price levels and of the intent and desire of the principal central banking authorities of the world to control credit in such a manner as to avoid inflation, and regardless of the opinion of many of our best students of monetary science who foresaw, and still foresee, a comparative stability in price levels for a number of years to come.

It will not do, however, to attack the recent stock market mania merely by stump speeches and broad generalizations. The facts are rather clear that the great mass of investors, who based their actions more on instinct and a subconscious sense of the possibilities of the future, than they did upon elaborate statistics and analyses, had sensed a situation that the old type investment expert had failed in some degree to recognize. All of us who studied the probable trend of investment markets after the War had the full expectation that declining interest rates and the higher general price level would be reflected, in due course, in higher common stock prices. What we did not fully realize, perhaps, was that there were other new elements coming into the situation, through increased technical research and through improvements in the science of management, of such sort as greatly to increase both the stability of earnings and the rate of growth in earnings for the leaders in each line of industry. Furthermore, many of us who have worked most earnestly in the attempt to stabilize general business and to reduce the severity and frequency of business depressions, did not realize that the public as a whole was beginning to give us credit for success in our efforts and was ready to discount this stability in an increased level of stock prices. And, as a final factor, most of us, I think, failed to make adequate allowance for the effect of investment trust buying, and the equivalent, in raising the average level of stock prices by eliminating, in some measure, the risk attaching to holdings concentrated in a single issue or a small number of issues. It is probable, also, that there was still a fourth factor to be taken into account, which was the influence of our rapid increase in per capita productivity on the creation of new and very rapidly growing luxury and semi-luxury industries with abnormally high rates of profit.

However, none of these recent developments in investment markets alter the fundamental factors that must be considered. The elements are identical today as yesterday. We must still consider past, present and future earnings, even though rates and stability of earnings may have changed. We must still consider the quality and durability of management, even though the principles of good management are more widespread than heretofore. And we must still weigh the possibilities of business depressions and changes, and of wars and natural cataclysms, even though we hope that business has become more stable and believe that peace treaties may have some real virtue.

As to detailed methods of valuing securities, perhaps the most important point to emphasize is the need for a preliminary general survey for the purposes of establishing the present and future position of the particular enterprise in the special line of business or industry with

which it is concerned, and of measuring the relation of such particular business or industry to business and industry as a whole. It is probable that more errors have been made in all types of estimates and forecasts by reason of failure to work from broad surveys step by step down to the particular survey required, than in any other way. It is almost invariably the case that, if special surveys are not controlled in relation to the grand totals of which they form a part, the summing up of a large number of such special surveys will lead to grand totals far in excess of any conceivable possibilities. This may be particularly true in the United States, as the result of a national spirit of optimism; and, in the reverse direction, it is quite possible that a summing up of such special surveys, in countries pessimistically inclined, would show deficits in the grand totals. However, whatever the national or individual bias may be, the necessity is clear for the establishment of broad controls before specific estimates are attempted.

To put the preceding in more specific form, if we are considering, for example, the automobile industry, we must begin first with the general picture of manufacturing as a whole in the United States, and with a figure of about 4 per cent as the average annual rate of increase in manufactured products. We should next examine the different classes of manufacturing, and will find that the manufacture of certain staples tends to increase at a rate only equal to, or perhaps even lower than, that of the increase in population (*i. e.*, between 1 and 2 per cent per annum), while other lines of manufacturing have an annual rate of increase of from 5 to 10 per cent, or even more. We will discover, also, that the automobile industry lies in that definite class of industries which represent new types of demand and are characterized by an initial very rapid growth, leading in the end to a partial or complete saturation of demand, and to a rate of output based primarily upon the need for replacements, rather than upon continuing large increases in the total use of the product.

In the same way, we may find that there are other industries that represent the development of special techniques in a wide variety of applications. Chemical research is being applied in this manner throughout a broad field, and a very special type of study must be applied to determine the growth of enterprises of this extensive type. In the end, however, each class of business may be sorted out and some rough measure, at least, of its future growth may be determined.

When the preceding survey of the industry as a whole has been completed, the next problem is to determine the present and probable future position of the particular enterprise in that industry. Here, again, it will be necessary to consider tendencies within the industry as a

whole, and to determine whether the industry is one that naturally lends itself to large scale operation or is one in which relatively small units can operate with full efficiency.

When all the preceding studies have been completed, the final step is to determine the probable rates of profit that can be expected (ordinarily figured in terms of a percentage of the gross business), and the new money probably required per dollar of increase in such gross business. In setting up these figures considerable reliance may be placed on general figures for average rates of profit on gross sales, and average rates of return on money used in other classes of business. The company, in any line, that can earn 15 per cent net on added money is doing an exceptional job, and a 10 or 12 per cent figure is much more common, even for successful and progressive companies. Similarly, a percentage of net profit amounting to 20 per cent of gross sales is exceedingly high, and a 10 to 12 per cent figure is more usual, while certain classes of business which permit a rapid turnover frequently show 5 per cent or less.

In judging the rates of net profit that may be expected, it will always be well to keep in mind Adam Smith's saying that, in his day, "double interest" was considered a fair profit. This observation still holds true. Double interest is the best general measure of the possible profits of successful enterprises. Coffee roasters, and merchandising companies in general, may show higher rates of return on the total money used, but only at the price of a greater risk of loss. The rule of double interest may be exceeded for brief periods by certain new and growing industries and by individual concerns in stabilized industries; but in the end, and usually within a five-year period, any such abnormal earnings will tend to swing back into line with those determined by the permanent laws of economics and competition, to which must be added in these days the not unimportant element of public regulation.

When the preceding general studies of the industry and of the particular business have been completed, the final step is largely one of arithmetic.

We must, however, begin with a definition: The investment value of a security is that price which, if paid today, should bring to the holder for a long term (or to maturity, if short term), after due allowance for the risk involved, a net return equal to the return upon substantially risk-free non-speculative investments having the same characteristics as to term, tax position, and legal availability for investment and bank reserve purposes. Such present investment value must take into account prospective distributions of interest, dividends and rights, as well as the prospective appreciation or depreciation in the investment value of the security.

In connection with the preceding definition, it should be noted that, for the same rate of return and risk, the investment values of securities will vary with their dates of maturity, if any, and with their classification as to tax exemptions and legality for specific purposes. These differentials between classes will shift from time to time with changes in basic interest rates and in tax provisions, and also with variations in the demand for the several types of issues.

It might be possible to set up a single definition that would be independent of (or, rather, adjusted for) all the preceding characteristics, but any such single definition would quite certainly be too complicated to be useful. Any general study of investment values must, therefore, be divided into two parts. The first part of the study should be a classification of securities into homogeneous groups, except as affected by risk and speculative possibilities. The second part should involve a comparison between groups, and particularly between the typical high grade investments that are used as the "measuring sticks" for each group.

In classifying securities for the preceding purposes, one group may have United States Government bonds as a base, another, the highest grade savings bank bonds, etc.

Common shares, in general, can be most appropriately measured against the rate of return received at market prices from the highest grades of non-callable preferred, and guaranteed shares. The problem of valuing any such common shares, as has already been indicated in a general way, involves first the setting up of the best estimates that can be made for, say, a ten-year period, of the growth of the enterprise, its earnings, its direct and indirect distributions to shareholders, and its new capital requirements. In addition, it will be necessary to fix an assumed market value for the shares at the end of the period.

With the preceding factors determined, the problem becomes simply that of discounting the future disbursements by, and payments to, the company, and the future sale value of the shares (plus their increase by stock splits, etc., if any), to present-day value, at a rate of discount equal to the return obtainable on the corresponding, basic, risk-free securities, plus an appropriate addition for risk.

In general, it will be found that the application of the preceding method leads to values of common shares which rarely, if ever, will exceed 20 times current earnings, and very generally will fall nearer the traditional ratio of 10 times earnings.

Some differences in the calculations may be brought about by the assumptions that are made as to subscriptions to new issues. If rights are figured to be sold as received, and the market price of such rights is

not assumed to be properly related to the real value of the security, the computations will show lower present day values per share than if all rights are assumed to be subscribed.

Calculations along the above lines must, of course always be used as a guide to, and not as a substitute for, good judgment. Their principal usefulness lies in indicating the maximum possible value of a security, rather than the price that actually should be paid. The calculations will be most useful, in fact, if they are made simultaneously on the basis of reasonable maximum and minimum assumptions as to the growth and financial progress of an enterprise. With these limits of value once calculated, the investor can then apply his personal judgment and general knowledge of the enterprise to determine the particular figures at which purchases or sales may be justified.

It is not to be expected that calculations of investment values made by any two experts will agree with exactness. Nevertheless, independent studies made along the lines that have been indicated tend generally to give values for particular issues that do not vary from each other by more than one-third. And if our investment statisticians can agree even this closely upon investment values, and can command public confidence in their calculations, they will have performed, perhaps, the most needed single service that can today be rendered by statistics to the cause of economic progress and stability.

CERTAIN ASPECTS OF THE INTERPRETATION OF PRICE-EARNINGS RATIOS

By Norris O. Johnson and John T. Shirer

The idea that price-earnings ratios are a trustworthy measuring-stick of common stock values was given a rude jolt in the great bull movement of 1924 to 1929. The stocks which were selling at what seemed to be the most outrageous price-earnings ratios often returned the most phenomenal profits, to those only, of course, who had the rare perspicacity to accept them. Much has been said of the increased interest which is being displayed in current earnings as opposed to the earnings which are fancifully anticipated for years hence. It has been the purpose of this study to scrutinize the price-earnings ratio in an effort to determine whether this device for relating prices to earnings justifies the esteem in which it is often held.

The price-earnings ratio, we know, may be defined as the reciprocal of the rate at which the equity earnings of a given company are capitalized. Whenever one speaks of a price-earnings ratio as being too high or too low, the implication is many times made that there is a certain figure at which all equity earnings should be capitalized. We believe that we are safe in saying that the discerning student of security values does not adhere to this viewpoint. To state dogmatically that stocks should sell at ten times earnings, which means that $10 should be paid for each dollar of earning power, regardless of the character and characteristics of those earnings, is as absurd as stating that all bonds should sell to yield 5 per cent without consideration to the nature of the obligation and the assets and earning power of the debtor party.

Even superficial observation conspicuously reveals the limitations, or we might say, conditioning elements, of price-earnings ratios. Of the wide variations in these ratios encountered, many may be rationalized in some way or other. Certain of these explanations can be enumerated as follows: (1) the temper of the speculative community; (2) the secular trend of price-earnings ratios; (3) misleading earnings reports; (4) the sustaining influence of book values; (5) the variability of earnings and (6) the slope of earnings.

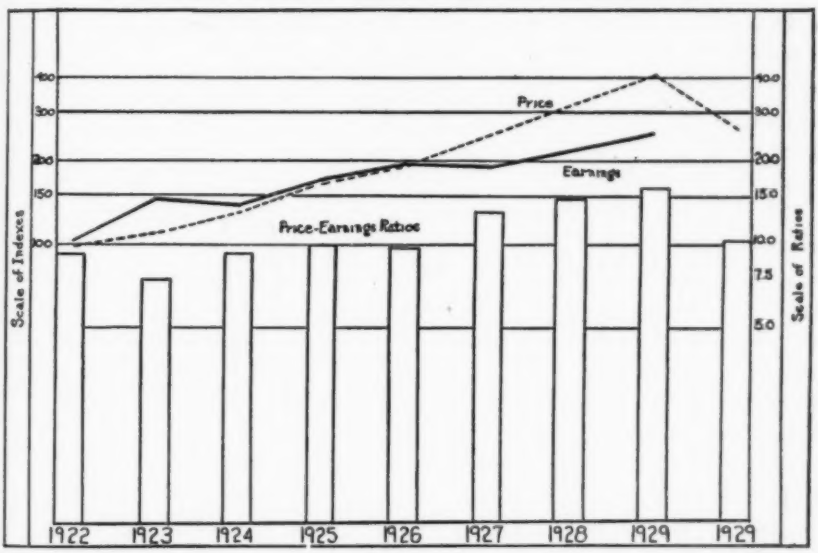
In attempting to measure in some way the effect of each of these conditioning elements it had been our hope to make use of a set of stocks generally accepted as representative, such as those making up the Dow-Jones averages. The use of the issues comprising these indexes, however, would involve such extensive and perplexing problems

of adjusting both prices and earnings due to a number of sweeping capitalization changes, that the original price-earnings ratios might have been lost sight of. A composite index has been employed to show what a given group of stocks has done, but we have chosen to place emphasis on individual issues rather than on groups of stocks.

Approximately 350 issues were considered in making this study. Twenty-four of these, showing various price and earnings characteristics were selected for an index which, incidentally, includes 14 stocks

CHART I

INDEXES OF COMMON STOCK PRICES, EARNINGS, AND PRICE-EARNINGS RATIOS, FOR 24 COMPANIES FROM 1922–1929, STOCK PRICES IN LATTER YEAR REPRESENTED BY AVERAGE FOR FIRST NINE MONTHS AND NOVEMBER LOW



used by Dow-Jones. The composite is employed to illustrate the first of our six points, the effect of the temper of the speculative community on price-earnings ratios.

Chart I shows, first of all, the geometric means of price-earnings ratios of our group of stocks from 1922 to 1928. The last two bars indicate the relationships of estimated 1929 earnings, with the stock prices of the first nine months of 1929 in the one case, and with the low points of November in the other. The two curves enable us to trace the sources of changes in the ratios. The dotted line represents a geometric-mean-chain-index of stock prices with the prices for 1922 equal to 100. The solid line represents a similar index of per-share earnings of these companies adjusted to a base which makes the two curves

coincide when the stocks are selling at ten times earnings. The use of this particular base is not designed as a payment of respects to the ten-times-earnings notion, but it is found convenient for comparative purposes.

The high price-earnings ratio of 1922 appears worthy of note because it indicates that stocks in years of abnormally low earnings do not sell at levels which can be considered commensurate with those earnings. In 1923 earnings made a conspicuous gain with stock prices mildly higher so that the ratio dropped from 9.7 to 7.5. Prices moved upward in 1924 despite a recession in profits and the price-earnings ratio became 9.3. Price and profit increases from this point to 1926 were roughly equivalent so that the ratio was fairly constant. Speculative enthusiasm is reflected in the enlargement of the price-earnings ratio from 9.9 in 1926 to 13.1 in 1927, 14.7 in 1928 and 16.1 in the earlier period of 1929. The bull market was based upon increasing price-earnings ratios superimposed upon generous earnings gains. At the low point of November the price-earnings relationship became roughly comparable to those of 1925 and 1926.

The second of the factors which condition the use of price-earnings ratios is the secular trend. The tendencies which create this long-time movement, primarily larger aggregate investment demands and increasing relative popularity of stocks as opposed to other types of investments, have been ably discussed before by others and the point does not seem to require further elaboration. We only wish to call attention to the fact that these influences impart a positive secular trend to price-earnings ratios.

Thirdly, in using price-earnings ratios we must keep in mind the possibility that earnings reports may not fairly reflect the true profits of a corporation at a given time. It is not difficult to find instances of what has been called overconservatism—the setting up of special reserves and the charging of excessive depreciation and depletion with no apparent rime or reason. On the other hand, some managements have been accused, justly or unjustly, of distorting income statements for the unwholesome purpose of private gain. Some companies make large capital expenditures which do not find reflection in earnings for quite some time. Mergers and recapitalizations often make the task of determining true earnings either impossible or arduous.

The fourth point to consider along with price-earnings ratios is book value. It has been our observation that the latter generally exerts an important sustaining force on security prices. There are large equities generally behind railroad and steel stocks, for instance, and these securities tend to drift upward and downward with the market tide, seem-

ingly little disturbed by year-to-year undulations of income, although tempered by the long-time trend of that income. We can understand the market action of Baldwin Locomotive old common stock only on the basis of its property equities. This stock failed to sell more than a few points under 100 from 1924 to 1928, despite the fact that deficits were shown in three years of this period and substantial earnings in only one. Yet Baldwin scored a notable advance in connection with reports involving the company's real estate holdings in Philadelphia. Obviously, equities rather than earnings played the dominating rôle in this movement. On the other hand, we find that other stocks, with small equities relative to the prices at which they sell, often follow earnings faithfully. General Motors and Union Carbide are admirable examples.

Our fifth conditioning element, the variability of earnings, is sometimes bound up with book values and it is often difficult to segregate the two forces. As noted heretofore, rail and steel issues normally have large equities, often considerably in excess of market prices, and it is problematical whether the book value or the generally well-maintained level of earnings is the predominating element. The flat curve of the price of Southern Pacific seems to bear a relationship to equities and the general level of earnings, rather than to year-to-year fluctuations in earnings. The same thing holds true of United States Steel. Price-earnings ratios for any single year in these cases are misleading without a longer range viewpoint.

The maintenance of perspective becomes increasingly important in the case of companies whose earnings fluctuate more erratically. There is little basis for believing that large earnings gains of companies of characteristically irregular earnings will push their stocks upward to a comparable degree. Goodrich reported $10.58 per share in 1924 against 80 cents per share in 1923 and the stock declined. In 1928 this company reported $1.50 per share as compared with $15.44 per share in 1927 and the stock advanced to the highest point in the history of the company. There is no reason to be misled by the movement of earnings to an impermanently high figure. Price-earnings ratios in these cases are widely exaggerated from year to year and have limited significance.

We believe that the sixth of our factors conditioning the use of price-earnings ratios, the slope of earnings, deserves special emphasis. It appears to be the stocks with the greatest positive inclinations of earnings which show the most gratifying profits in a bull market. These securities could normally be expected to show very substantial advances even upon the hypothesis of a constant price-earnings ratio.

The fact is, however, that this group of issues in the last upward movement showed the greatest gains in price-earnings ratios, and profits were thus compounded. The companies with relatively flat earnings trends received less attention.

In addition to the limitations of price-earnings ratios above outlined, we must remember that deficits disqualify the application of this particular measuring-stick in the case of many companies. There are, moreover, special sets of circumstances surrounding each particular stock, for stocks are highly individualistic. Yet the price-earnings ratio seems to have a distinct utility when considered in the light of its conditioning elements and special circumstances, if only because its disparity from so-called "normal" standards gives birth to curiosity as to what those special elements may be.

DISCUSSION

By Lionel D. Edie

The emphasis placed by Mr. Rorty on the importance of a general approach to the study of industrial growth may well receive hearty approval. Most of the literature on trends is confined to curve fitting. It is primarily of a mathematical and statistical character. General economic science has dealt with trends under the headings of increasing, decreasing or constant cost. However, the assumptions made by economists for purposes of abstract theory result in a form of analysis which is not very helpful to the student of security valuation. Undoubtedly, there is need of broader discussion of trends from the standpoint of the investor. Such study will show many types of trend with particular governing factors in each case. It will lead to a classification of industries and companies from the standpoint of their respective types of trend. It will also lead to further information on what has been called the life history of an industry or a company. This concept implies that a trend has successive stages or phases, and should be broken down into these component parts. The economics of trends will develop a literature which goes considerably beyond our existing information in this field.

However, when Mr. Rorty states that after the general studies have been made, "the final step is largely one of arithmetic," it is difficult to stand in agreement. Too many things enter which involve arbitrary judgment. For instance, there must be "due allowance for the risk involved." Also a basic interest rate must be assumed. Moreover, there must be estimates of "prospective distribution of interest, divi-

dends and rights as well as the prospective appreciation and depreciation in the investment value of the security." Finally, the process involves forecasting earnings and other factors of the business ten years in advance and the assumption of a market value for the shares ten years hence. All of these steps are more than simple arithmetic. Mr. Rorty admits that two different individuals working on the same company will arrive at final estimates of value differing by 50 per cent. This in itself is a very wide margin of error and throws grave doubt upon the practical value of the results. Of course, there is the additional possibility of error in the chance that both estimators may have a strong bias upward or downward. The uncertainty of such results tends to confirm my previous impression that elaborate methods of valuation are open to serious criticism.

Criticism may be especially leveled at the tendency of late to value stocks by assuming some arbitrary earnings ratio. Mr. Rorty concludes that a true earnings ratio will rarely, if ever, exceed twenty times earnings and will generally fall nearer ten times earnings. This generalization seems to refer equally to bull markets and bear markets. I am convinced that before we can make much use of earnings ratios, we must have more information of their laws of behavior. In spite of the fact that America is a land rich in index numbers, we have no adequate published index number of earnings ratios. If we can set up such an index number, we shall need to treat it by the usual time series analysis, breaking it up into trend, cycle, etc. I feel quite certain that one result of such a study would be to destroy the tendency to think in terms of the fixed ten times earnings ratio as "normal." It would lead to more adequate reasons for adopting any given earnings ratio as a basis for capitalizing the earnings of an individual company.

A good index of average earnings ratios would have one great value as a measure of stock market inflation. Indexes of stock prices are averages of prices per share rather than prices per dollar of earnings. When the forward advance starts we are at a loss to know to what extent the advance is justified by reported increases of earnings and to what extent it is pure inflation based upon overexpansion of credit.

In general one has the impression that, after all, techniques for evaluation in this field are in their infancy. It is to be hoped that the emphasis placed by banks and investment trusts and other institutions upon research in this field will broaden such techniques rapidly in the years to come.

With regard to the interesting comments by Mr. Persons, probably no one will disagree with his observation that a diversification of in-

vestments aids in the assumption of risk. This principle, of course, has been drawn upon generously in late years by the investment trusts. The mere fact that most trusts were started in the midst of a great bull market apparently caused primary emphasis to be placed on analysis of individual stocks. Reliance was placed upon the principle of diversification and the risk of a major turn in the general market was not given as much attention as it is likely to receive in the future. No matter how much diversification there may be in a portfolio, the list as a whole is exposed to the risk of a collapse of market values all along the line. This risk needs to be brought more completely under control and challenges the attention of the economists who are working on investment problems in this field.

THE CENSUS OF POPULATION

By Leon E. Truesdell

The census of population has been taken every 10 years for 140 years. The 1930 census will therefore be, strictly and literally, the Fifteenth Decennial Census—of population, though for agriculture and manufactures, the next older members of the census family, it will be only the ninth or the tenth, while distribution, the latest addition, will appear in 1930 for the first time. Out of the 140 years of history, the population census has gathered a mass of traditions from which we break away with difficulty and on only a few points at each new census. (Not that we wish to break away, or ought to break away to any great extent; for the traditions are mainly good ones—the crystallized experience of our predecessors in the art of census taking.) Since 1850, every census except one has been taken on the same form of schedule—a sheet having on each side 40 or 50 lines, providing space for the entry of 40 or 50 names, with from 13 to 32 columns in which to enter the required items of information about each person. These schedules, like the earlier ones having entries by families instead of by individuals, are bound into volumes and stored in the archives of the Census Bureau.

Certain basic facts, such as color, sex, age, and marital condition, have appeared on all these schedules, and their omission or modification has not even been suggested; other inquiries of long standing, like illiteracy, school attendance, place of birth, citizenship, and occupation, have been retained with only incidental changes. These, I suppose, will be taken for granted. I shall speak more at length, then, about the new inquiries which have been added to the schedule for 1930.

The starting point for making up the 1930 schedule was, naturally, the schedule used in 1920. We studied the 1920 questions very carefully and decided there were 4 or 5 that we might venture to take off, so as to leave room for an equivalent number of new questions. The next task was to select the new questions out of a list of about 40 candidates suggested and urgently recommended by various interested persons and organizations.

The new questions finally selected were as follows:

1. Value of home, if owned, or monthly rental, if rented.
2. Whether the family has a radio set.
3. Age at first marriage (for married persons only).
4. Whether actually at work. (For each person usually employed

but returned as not at work, additional information will be secured on a special unemployment schedule.)

5. Whether a veteran of the United States military or naval forces.
6. For each veteran, in what war or expedition he served.

The question on value or monthly rental of home will make possible a classification of families, at least roughly, according to economic status, or as our friends in the advertising business would say, according to buying power. Counting also the question on tenure of home (whether owned or rented) and the three questions on occupation, this makes 5 questions out of a total of 24 (not counting those on unemployment) which are devoted to economic factors, as against 19 questions relating to sociological or demographic factors.

The inquiry as to whether the family has a radio set will give direct information relative to the size of the potential radio audience and will satisfy what appears to be a rather widespread curiosity.

The question as to age at first marriage is what there is left of a set of four questions which have been carried on the schedule at a number of previous censuses (last in 1910) but have never been tabulated except for small sample areas. The other three questions are (1) number of children born to each woman; (2) number of these children living; and (3) whether first, second, or subsequent marriage. The argument for the one question as a fairly acceptable substitute for the group of four is based on the assumption that a tabulation of the number of children reported on the schedule as members of the family for women who have been married, say 15 years or less, will indicate accurately the relative size of the families of children being raised by the different racial groups of the population and in rural and urban areas. Incidentally, the data on age at marriage will have considerable social significance of their own, quite apart from their use in the tabulation just mentioned.

The unemployment inquiries will receive attention later on the program, so I need say nothing more about them here.

The questions on veterans were placed on the schedule solely for the purpose of supplying information desired by the Veterans' Bureau.

To make room for the new inquiries the following questions, carried in 1920, were dropped:

1. Whether home was mortgaged or not (owned homes only).
2. Date of naturalization (for naturalized foreign born only).
3. Mother tongue of father.
4. Mother tongue of mother.

And the two questions on ability to read and ability to write were consolidated into one, "Whether able to read and write."

There are also some new features in the census plans which do not involve new questions on the schedule. For example, women doing housework in their own homes (or supervising such work done by servants) and carrying the other responsibilities of the home will be designated as home-makers. This designation will be entered in the family relationship column on the schedule, rather than in the occupation column, in order that those women who follow a profession or other gainful occupation, in addition to being home-makers, may be properly classified in respect to both lines of activity.

Tentative provision is being made for showing the population of townships or other minor civil divisions of the counties, classified by color, sex, and age—something which has not been done heretofore for units smaller than counties. Further details in the county presentation, especially more subdivisions by age, are also included in the plans.

The rural population is to be subdivided into farm population and rural non-farm population throughout the census reports, provided a satisfactory definition of farm population can be worked out.

In the classification of gainful workers according to occupation greater stress is to be placed on the returns for the industry in which the person works, both in the instructions to the enumerators and the publication of the results. With the increasing complexity of American industrial organization, and the rapidly changing terminology, the occupational classification furnishes one of the most difficult, if not the most difficult, of the problems involved in the census. For example, in the industrial classification, how should a person be classified whom the enumerator reports as a laborer in a garage? Even with regard to the major industrial groups there is serious question. If the "garage" is merely—or mainly—a place to store automobiles, then he should go under "Transportation"; if it is mainly a place for selling gasoline and supplies he should go under "Trade"; or if it is mainly a place for making repairs, etc., he might properly go under "Manufacturing." But which, when we have nothing to go on except the enumerator's entry, "Laborer—garage?"

Other problems of classification will arise in connection with the returns of country of birth, especially of the country of birth of the fathers and mothers of adult persons of foreign parentage. What is wanted is, of course, the location of the place of birth according to present-day political boundaries. But many a person will report that his father was born in Austria, without knowing, perhaps, whether the birthplace is in what is now Austria, or in Poland or Czechoslovakia. We are asking for the province or city as well as the country in such cases, and are preparing an index of the cities, provinces, and some of the smaller

geographic subdivisions in those European countries which lost territory in the post-war readjustments; but even with this index, there will be countless individual problems to be settled after the schedules are received. And at best, one might as well admit, a good many more persons will be credited to Austria, for example, than were really born in what is now Austria.

Many other uncertainties and a thousand and one varieties of inconsistencies will appear on the schedules and will have to be settled or adjusted by the clerks "editing" and coding the schedules in preparation for the punching of the cards. An eminent English statistician made the statement, many years ago, that the question on sex was the only really simple question on the typical population schedule. Even this question is not absolutely fool-proof, however, for now and then a case will appear where both John Smith and his wife, Mary, are returned as "male." This error and others of like obvious nature must be corrected by the clerks doing the preliminary work on the schedules; and likewise with other inconsistencies, like the return as naturalized of a person who had been in the United States only 2 years, or the return of a 12-year-old girl as a blacksmith.

Out of the total number of entries on the population schedules—from 11 to 32 possible entries for each of 122,000,000 persons, or a total of around 2½ billions—the numbers that are found defective really form a very small fraction; but like the naughty boy in a schoolroom who causes the teacher more worry than the 39 well-behaved pupils, this small fraction demands far more than its fair share of time and attention in our planning.

UNEMPLOYMENT AS A CENSUS PROBLEM

By Charles E. Persons

The problem of census taking when it touches unemployment must differentiate between the "will works" and the "won't works"; between the "can works" and the "can't works." Every society has among its industrial labor force a gradation in character and efficiency starting at the bottom with the criminals and tramps; the idiots and imbeciles; the professional seekers of work who continuously manage skillfully to avoid finding it; and the permanent population of almshouses and municipal lodging houses. The scale rises through the hobo or casual and intermittent worker class; the feeble-minded and moron group; the shiftless and carefree whose low standard of living is satisfied with the results of a few days' toil monthly; and the inefficient, handicapped or substandard workers. At the border line of those fully efficient is a debatable area filled by workers capable in physique and often skilled but inferior of character, overfond of alcoholic beverages, resentful of discipline, incapable of team work or afflicted with wanderlust. For personal reasons, not because of defects in the industrial organization, these individuals are in and out of industry periodically. Whether they are casual by nature and a process of selection has lodged them in casual industries or whether the casual nature of their work has developed a casual character as a protective device, is one of the unanswered questions in modern industry. The presence of such a group of doubtful industrial character is one of the facts as stubborn as troublesome when censuses are taken of the unemployed.

Planning an unemployment schedule, the inquiries on which must be of general application to the gainful workers among 120,000,000 people spread over a continental area, in the widest possible variety of industrial conditions and with all imaginable complications, is a labor fit to be propounded to an up-to-date 100 per cent efficient statistical Hercules. He will have serious need for the wit of a superman, an encyclopædic grasp of industrial information, and wisdom commensurate to his possession of facts. He will not meet his problem adequately unless he has the courage requisite for the cutting of many Gordian knots. The appreciation of the character of the debatable ground surrounding the core of the problem of unemployment and the examination of the results secured in previous enumerations of the unemployed will furnish him certain suggestions. The questions on the

schedule must be free from ambiguity and capable of definite answer. The "freedom from ambiguity" must be complete, even when the questions are handled by 100,000 enumerators of the sort that can be secured to undertake a short-time job in the month of April. The questions must be capable of direct and accurate answer, even though the information is received from the housewife rather than from the individual worker. In many cases the informant will be much farther removed from the gainful worker whose unemployment is in question. The boarding-house keeper will answer for her boarders; landlords for tenants; neighbors and friends for workers absent when the enumerator calls. Hence inquiries must be simply put.

And this conclusion is doubly true of the questions which determine the inclusion of the worker among those enumerated on the unemployment schedule. The earlier questions as to the number of months unemployed in a census year fell short of complete success. They were ambiguous, or at least not fool proof, for the enumerators frequently returned the months of employment rather than of idleness. They were not capable of exact answer. No one has supposed that the reported statistics in 1890 and 1900 showing the number unemployed the longer periods were anything more than approximations. The census is taken as of a certain date. The unemployment census should confine itself to enumerating the unemployment of that date. For each gainful worker it should ask: "Was he employed on a certain day?"

Since it is essential that the results be analyzed and interpreted in accordance with consistent rules, information should be recorded on the schedules for all gainful workers found idle. This information should be extensive enough to allow elimination of doubtful cases and the reduction of the total list to those: (1) usually employed, (2) out of a job, (3) able to work, and (4) looking for a job.

The age of the worker will be significant in the case of young workers whose instability of character explains many cases of idleness; and again in the case of older workers on the way to retirement. The cause for absence from a job or for losing the last job may throw light upon the causes for temporary layoff, voluntary or enforced, and for the more extended and important cases of unemployment.

The inquiry must be simple. Part day unemployment is the least important and significant of the various forms of lost time. The arrangement of daily working hours is most complicated, widely variable, and not susceptible of reduction to generalized instructions for the guidance of the enumerator. For example, the Women's Bureau

reports for the canneries of Delaware: "Scheduled hours mean almost nothing in the canneries—there is so much overtime and undertime that any schedule would be warped beyond recognition." And again in the same report: "In a study of restaurant hours it is necessary to consider the schedules of individual women, since shifts and irregularities cause great variation in hours for the different workers within any one establishment." Short time per day will be excluded from consideration in the census taking. This Gordian knot must be cut. It defies attempts to untie it.

All past performances in unemployment census taking indicate that very sparing use should be made of long range questions. Without too sanguine hope that the answers will be accurate the unemployment schedule may venture to inquire how many weeks men have been without jobs. It may add a parallel question for those possessed of jobs regarding the weeks away from the job. The great difficulty here is to discriminate between "a job" and makeshift or provisional employment. A few hours' work at shovelling snow does not terminate a period of unemployment. On the other hand, many one-time miners, glass blowers, and cigar makers will never again be permanently employed in those industries. The makeshift jobs accepted as a temporary expedient may prove to be permanent. These men may have jobs, although they may not be inclined to accept that now as a true statement. The second inquiry is intended to sort out from those claiming jobs the fraction whose layoff has been so long as fairly to warrant their being counted among the unemployed. And its use is suggested by knowledge of the practice, in such industries as the railroads, of carrying on the pay roll all men laid off when employment shrinks. They are first to be offered their former positions when workers are again needed. In 1925 the Federal Bureau of Labor Statistics discovered that certain automobile establishments had reported as employed all whose names appeared on its pay roll "for several months during this period of declining unemployment." This included many laid-off employees "whose names had been retained on the pay roll because it was anticipated that they would later resume work with the concern."

The conclusion is that the census of unemployment should gather information regarding all gainful workers found idle on the census day. It should place emphasis on the possession of a job. The mandate of Congress is that those unemployed should be enumerated. A census deals with individuals, not with abstract problems, however great their intrinsic interest. Together with the main purpose of counting the unemployed—establishing a "bench mark" of unemployment—the

census will endeavor to gather information regarding the length of the period of unemployment and the causes of absence from, or separation from, jobs. It will be guided always by the consideration of the main chance—the fulfillment of the mandate. Subsidiary questions must yield thereto.

THE CENSUS OF MANUFACTURES

By LeVerne Beales

In preparation for the census of 1929, the Secretary of Commerce appointed an Advisory Committee on the Census of Manufactures, whose membership of 25 comprises important manufacturers, economists, statisticians, students of labor conditions, and others interested in the census statistics. This committee, after a careful and intensive study, made certain recommendations to the Bureau of the Census in regard to the form of schedule to be used in the census for 1929. All these recommendations were adopted. The committee took the stand that, since the coming census not only will form one of the biennial series, which began a decade ago, but will also be included in the decennial series, which extends back for more than three-quarters of a century, its results should be published in such form and detail as to be fairly comparable with those of preceding decennial censuses. To this end the schedules adopted were expanded considerably as compared with those used at the preceding biennial census. As compared with the 1919 schedules they call for somewhat more detail in some directions and for somewhat less in others. In all, one general schedule and 166 special schedules will be used. The outstanding differences between the general inquiries—those which appear on both the general and the special schedules—for 1929 and the corresponding inquiries made at the census for 1919 are as follows:

NEW ITEMS

Inquiry 1, Description of Plant, calls for a statement as to whether the plant has changed its name, location, ownership, or general nature of business since January 1, 1928. From the answers it will be possible to compile statistics in regard to migration of industry between 1927 and 1929.

Inquiry 4, Time in Operation and Hours of Labor, calls for data as to number of hours of labor per week for individual wage earners.

Inquiry 10, Power Equipment, provides for the separate reporting of idle power equipment.

Inquiry 12, Distribution of Sales, calls for a classification of sales as made to other manufacturers, to wholesalers and jobbers, to retailers, etc.—nine items in all. This, the most important of the new inquiries, has been placed on the manufactures schedule for the sole benefit of the Distribution Census.

ITEMS CARRIED ON SCHEDULE FOR 1919 BUT NOT ON THAT FOR 1929

Capital Invested; Rent and Taxes.—These inquiries were dropped from the schedule at the beginning of the biennial series of censuses and have never been restored, the data collected at the earlier censuses having been far from satisfactory.

Wage earners for December 15 or other representative date, classified as under 16 years of age and as 16 years of age and over.

Wage earners by months, classified as male and female.

The 1929 schedule calls for a sex classification of wage earners for December 14 or other representative date, and for data on monthly wage-earner employment, but does not provide for a sex classification of wage earners for each month.

SUBSTITUTION OF SALES FOR PRODUCTION

This change has aroused more controversy than all the others combined. It was the opinion of the majority of those who expressed themselves on the subject that manufacturers as a rule can report their sales during the census year more easily than they can report their production; and this is the sole reason for the change. Naturally, correct statistics of production are preferable to statistics of sales, but it is known that many manufacturers have actually been reporting their sales and not their production, and it was believed, therefore, that the Census Bureau should ask for what it can undoubtedly obtain from all manufacturers, rather than for what only a part of the manufacturers could and would report, as has been done heretofore. The change is, however, in the nature of an experiment; and if the results are unsatisfactory the production basis will again be employed at future censuses. I may add that the change has brought forth bitter protests from certain industrial associations, and in deference to the wishes of those associations, the schedules for certain industries will call, as heretofore, for data on production, not sales.

In certain preceding censuses the punch-card system has been employed to some slight extent in tabulating manufactures statistics, but the results have not been satisfactory because of the impracticability of verifying the data as punched on the cards against the figures in the manufacturers' returns. The tabulating machinery now in use, however, makes verification easy, and accordingly it will be practicable to employ the punch-card system for tabulating the "general statistics" for industries and for States, counties, and cities, although the punch-card system is not adapted to the tabulation of the detailed data for quantities and values of products. This will greatly expedite the compilation of county and city statistics.

Thus far county statistics have been compiled at only two censuses taken within the present century, namely, those for 1919 and 1927. These statistics are restricted to a few general items representing combined totals for all industries, no attempt having been made to present statistics for individual industries. At the census for 1919 statistics by industries were compiled for all cities having 50,000 inhabitants or more, but at subsequent censuses no such statistics have been compiled for cities having fewer than 100,000 inhabitants. For 1925 and 1927, combined statistics for all industries, but not for individual industries, were compiled for all cities having 10,000 inhabitants or more.

The statistics by industries for some of the cities having 100,000 inhabitants or more are highly unsatisfactory because of the necessity for withholding from separate publication the figures for some of the most important industries, in order to avoid disclosing the data for individual establishments. For example, in the case of Albany, New York, it has been possible to give separate statistics for only a few industries which together contributed about one-fifth of the aggregate value of products for all industries in the city; and for Flint, Michigan, General Motors overshadows all other industries to so great an extent that it is possible to publish only the combined totals for all industries. At the coming census it is the intention, in presenting statistics for cities having 100,000 inhabitants or more, to break down the "All other industries" group into a number of items each representing one or more of the sixteen great groups into which all industries are classified.

In the cases of counties it is probable that statistics for each of the sixteen great groups or for combinations of these groups will be assembled for each industrially important county or for groups of contiguous counties.

It will be impracticable, for certain reasons arising from the necessity of presenting the statistics in such a manner as to avoid disclosing the data for individual establishments, to publish industry statistics for industrial areas and also for the included cities. It is the present intention, therefore, to prepare and publish statistics for individual industries for industrial areas and combined statistics for all industries for both the industrial areas and the included cities. For the purposes of the 1929 census of manufactures each industrial area must consist of one or more entire counties. It may be that at future censuses it will be possible to publish manufactures statistics by industries for areas made up of central cities and of adjoining parts of counties; but this will be out of the question at the census for 1929, because the boundaries of such industrial areas must be established on the basis of the

returns of the population census of 1930, and this cannot be done in time to serve the purposes of the manufactures census for 1929.

It has been planned to compile the preliminary reports for individual industries from the returns as received from the manufacturers, with very little editing or attempt at verification of doubtful items, in order that they may be published with a minimum of delay. The margin of error may, therefore, be greater than heretofore, but care will be taken not to publish figures that are seriously out of line with the corresponding ones for previous census years.

These preliminary reports will give figures for number of establishments; number of wage earners; wages; cost of materials, fuel, and power; total value of products; and quantities and values of products in detail. These detailed quantity and value figures, which will cover numerous items in the cases of many industries, will supply the information in greatest demand, so far as the manufacturers are concerned. Those interested in detailed statistics in regard to monthly employment of wage earners, hours of labor, power, etc., must wait until the Bureau has time to verify and correct the incomplete and incorrect returns which will inevitably be made by scores of thousands of manufacturers. This work will be done as rapidly as possible, but it will necessarily consume many months of time.

THE CENSUS OF DISTRIBUTION

By Robert J. McFall

The census of distribution is projected to cover the mercantile distribution of goods and the agencies which distribute them. The term "distribution" does not in this connection follow the use of this word by theoretical economists who use it as applying to the distribution of wealth. No direct attempt whatever is being made to ascertain the distribution of wealth. No evidence concerning the distribution of wealth between economic classes will be obtained. It is true that real evidence will result concerning the geographical distribution of the buying power of the whole population. This study is akin to a marketing study in that it applies to merchandizing. "Distribution" for us means "merchant-distribution."

The census of distribution is being taken to find out basic facts about our national distributing system in order that these facts may be used to make this system more efficient.

We have very much more statistical information about production, such as agriculture and manufacturing, than we do about distribution. Partially, at least, as the result of having so much more information on production, this part of our business world has progressed in efficiency much more rapidly than distribution has. It is believed, therefore, that our distribution system can be considerably improved on the basis of the information which will come from this census.

Improvements in distribution will help the merchants, manufacturers and farmers, and, in the end, will also prove beneficial to the consuming public.

The census of distribution covers merchants or distributors and their business operations. It will give a classified count of the various classes, types and sizes of retailers, wholesalers and all other merchandizing concerns in the whole country, their sales, expenses, inventories and employees. It will give as much information as possible concerning the goods sold by these various distributors; the chief limit to such information being the scanty records kept by the rank and file of merchants.

As much as possible of this information will be summarized for each city and county as well as for each state and the nation as a whole.

The merchandizing operations of manufacturers' sales branches will be included. In connection with the census of manufacturers, information is being collected showing the utilization of the leading

materials by the leading industries. Information is also being collected showing to what extent manufacturers sell through wholesalers, or direct to other manufacturers, to retailers, direct to home consumers, etc. In this way, a very comprehensive picture will be shown of all phases of merchant-distribution.

No attempt is being made to obtain information concerning the profits of the merchant-distributors. We are even omitting all questions which would show the gross margin between purchases and sales. The value of the sales will be ascertained, but the cost of the goods purchased will not be included. It is generally agreed that such information would be extremely useful from all points of view, if obtainable within a safe margin of accuracy. However, it is generally conceded that the low quality of bookkeeping records in general and the extreme variation in methods used in treating various items of payment make it impossible just now to explore this field on a census basis without undue danger of giving misleading results. The probable error in any possible results would be dangerously large as compared with the relatively small part of the gross income left for profits.

One question is being asked covering the amount of rent, if any, that is paid for the premises. Another is asked to cover the amount of interest paid. A separate question is then asked as to the amount of all other expenses excluding rent, interest, wages and cost of goods purchased. In this way, much valuable information will be obtained regarding the contribution of merchant-distribution to the economic activity of the nation.

Place-to-place movement of goods is not being covered by this census. For this reason the operations of railways, steamship companies and trucking agencies are not included.

It will be of value to all merchant-distributors to know the importance of their group in the whole business world. General knowledge of the numbers of people engaged in the field of distribution (whether as proprietors or employees), the value of all goods distributed, and the expenses of distribution will help the merchants more fully to realize the importance of their work. It will also help them to educate the general public regarding the importance of merchant-distribution in our business life.

It will be of practical importance to the whole business community to know the proportion of each type of business done by distributing concerns of various kind and size. Among other information needed by business executives is the following: What proportion of the distributing establishments are units of chain organizations, and what

proportion of the business is handled by the chains? How many concerns are there whose turnover could not possibly give the proprietors a comfortable income? On the other hand, what proportion of our business is done by large concerns? In other words, what part in merchandizing is being played by the large concerns, what by the medium-sized concerns and what by the small concerns? The rate of mortality in business concerns is also a matter of real weight. The questions on the age of the business will shed excellent light on this problem. This census will give answers to all these questions.

Every merchant will be in a position, from the opportunity which will be given, to compare his own particular business with that of groups of others in his general locality and in the nation as a whole. Comparisons may be made regarding amount of sales by type of business, proportion of business done on credit, amount of returned goods, inventory, expenses, number of employees, wages and various other items. In this way some of the blindness will be taken out of competition. The reports of this census will be something like a trade convention on a large scale in which merchants exchange many lessons drawn from their practical experiences.

Retailers in particular should know the numbers of concerns of each type and size in their own community and the average situation of each group as to inventory, expenses, employees, services, etc. They should know the proportion of business done by chain stores, versus the regular trade. They should also know the degree to which stores of each type sell goods more generally supposed to be sold by stores of another type. They should be fully acquainted with the retail facts of their region regarding the proportion of sales made on credit and what proportion of sales are offset by returned goods.

Retailers, either individually or collectively through their associations, should familiarize themselves with the distributing system which places the goods in their hands. The results of the census covering the operations of wholesalers and the merchandizing operations of the manufacturers will yield facts that should be studied carefully by the retail trade.

Wholesalers will gain from a study of the returns of wholesalers just as the retailers will benefit from the returns of other retailers. They will gain just as much as, and probably still more than the retailers, from a study of the distribution operations of others than their own class. They will learn what the consumer demands are in various parts of the country, what type of retail outlets there are for their goods in each section, and how such outlets compare as markets for their goods. They will also learn the extent to which retail sales are

concentrated in the hands of various groups of retailers as classified either by size of business or type of trade.

Manufacturers and their sales agents, including advertising concerns, will learn much of value to them from this census. Their task being to sell goods or to help in creating demand for them, it will be greatly to their advantage to obtain more exact facts than are now available about the numbers, types and sizes of retailers, wholesalers and other distributors in the country as a whole and in each of its geographic divisions. The census will also show the extent to which various types of goods are sold through all the regular trading channels, what part goes direct from manufacturers to other manufacturers, to retailers or even to the ultimate consumers and what part is disposed of through manufacturers' agents. This census will give comprehensive information for the first time about the distribution of industrial goods—which are manufactured goods, the buyers of which are other manufacturers rather than the ultimate consumers. These products are worth many billions of dollars in our annual operations, but so far little has been done to give the business world systematic information about their marketing. This census will bring out the outstanding facts concerning the marketing of these goods.

Farmers who have their own organized selling agencies can reap many of the same direct benefits enjoyed by the manufacturers. Moreover, anything that makes the system of distribution more efficient will help the farmers, for it is generally recognized that expenses of distribution are matters of serious concern to the farmers.

Demand for better statistics covering the field of distribution has been growing for years. This resulted, in 1925, in a general conference concerning distribution held under the auspices of the Chamber of Commerce of the United States, at which the Committee on the Collection of Business Figures was appointed. The first important meeting of this committee was held in New York in December, 1926. In conference with the Director of the Census, it was decided to take a test census of distribution in Baltimore during the early part of the year 1927.

This experiment in Baltimore revealed that there was a great deal of valuable information that could be gathered from the retailers and wholesalers and it was decided to extend the trial census to several other cities. In coöperation with the Chamber of Commerce of the United States, the following cities were covered: Atlanta, Georgia; Chicago, Illinois; Denver, Colorado; Fargo, North Dakota; Kansas City, Missouri; Metropolitan Providence, Rhode Island; Metropolitan San Francisco, California; Seattle, Washington; Springfield, Illinois; and Syracuse, New York.

Immediately upon completion of the work of collecting the data in each city, compilations were started and a preliminary statement prepared for publication by the Bureau of the Census showing the principal facts. More detailed compilations were later made by the Bureau and published by the Domestic Distribution Department of the Chamber of Commerce of the United States. These figures showed the number of establishments by classes, the number of employees, their salaries and wages, the inventory and sales for each of approximately seventy-five commodities, and in what type of stores these commodities were sold.

Immediately after the reports got into the hands of the business men this experimental census of distribution met with an enthusiastic reception and there was a widespread demand to have a nation-wide census of distribution taken in conjunction with the forthcoming Decennial Census. As a result, the act authorizing the Fifteenth Decennial Census provides for the taking of a census of distribution on a nation-wide scale for the first time in history.

We are not using a large number of forms, and the chief questions are the same on all forms. These chief questions, including the total value of sales, will be asked of all establishments. No attempt will be made to have the very small concerns break down their total sales into classes of commodities. In every case, however, the total sales will be classified by type of store. A breakdown of sales into the chief classes of commodities will be secured from as many of the large and intermediate concerns as possible. These commodity returns will be added up on the basis of types of stores and related to the total sales of all the stores of these same types. It is utterly impossible to obtain a commodity breakdown of sales for all stores. However, these plans will furnish a large sample breakdown for a known proportion of each type of business.

The census of distribution will thus give a complete classified census of distributors and as much of a census of their distribution of goods as it is practicable to take at this present time.

THE CENSUS OF AGRICULTURE

By William Lane Austin

The importance of the census of agriculture in 1930 can hardly be overestimated since agriculture is still the great fundamental industry of the United States. This census will supply the data upon which official estimates are based for the succeeding five years.

The farm census is taken primarily for the benefit of farmers. Upon the accuracy of the information given by the farmer depends to a large extent the value of the statistical work to be carried on in the farmer's behalf, not only by the Federal and State Departments of Agriculture, but by students of agricultural conditions in all parts of the world.

The census of agriculture in the United States in 1930 will not only be a census of all farms, but also of incidental farm products and livestock not on farms, and of irrigation and drainage enterprises. There will be eight separate schedules. The first and most important of these is the General Farm Schedule.

More than twenty months were given to the preparation of this schedule by a joint committee composed of representatives of the United States Department of Agriculture and of the Bureau of the Census. The General Farm Schedule at every census must be more or less a compromise among various sections and various interests.

The joint committee received and discussed more than 2,000 suggested questions. The final schedule prepared, the one to be used in the enumeration next April, is the thirteenth one. Agricultural colleges, State departments of agriculture, agricultural publications, students of agriculture, and many real "dirt farmers" were consulted by members of the committee, both personally and by correspondence, before deciding upon the makeup of the final farm schedule. By following this procedure, the committee was enabled to consult every section of the United States and practically all interests involved in the farm census of 1930.

The General Farm Schedule adopted by the joint committee for the 1930 census is comprehensive and complex. It contains approximately 350 questions—more than 50 of which have never been asked before in an agricultural census. One of these schedules must be made out for each of the six and one-half million farms in the United States. However, each farm operator will answer only the questions which apply to the farm he operates. All inventory items of the schedule are to

be given as of April 1, 1930; and all production items relate to the calendar year 1929.

The schedule may be divided into seven parts:

1. Personal information regarding the farm operator.
2. General information regarding farm acreage, farm values, and farm expenses.
3. Farm tenure.
4. An inventory of all livestock, including poultry and bees on April 1, 1930.
5. A statement of the quantity of livestock products produced in 1929 with the quantity and value of certain products sold.
6. A statement of the acreage and yields of all crops harvested in 1929, as well as the quantity of the principal crops sold or to be sold.
7. Miscellaneous information relating to the farm.

The personal information regarding the farm operator is his name, post-office address, color or race, age, period of his operation of present farm, number of days worked for pay in 1929 on jobs not connected with the operation of his farm, and his "occupation" as reported by him in the population census.

The general information regarding farm acreage, farm values, and farm expenses covers a series of questions. The total number of acres in the farm is subdivided into crop land, pasture land, and other land. The farm includes all outlying or separate fields, meadows, pastures, woodland or waste lands. Crop land is further subdivided into (1) "land from which crops were harvested in 1929" and includes all field crops, all tame and wild hay cut on this farm, and gardens, orchards and vineyards; (2) "land from which no crop was harvested in 1929 because of crop failure or destruction"; and (3) "crop land lying idle all of 1929 or land in summer fallow in 1929."

The value of the farm is the value of the land and buildings composing the farm and is the amount for which the farm would sell. Under farm values, separate questions are asked for the (1) "value of *all* buildings on this farm," (2) "value of farmer's *dwelling* house" and (3) "value of farm implements and machinery used in operating this farm, including automobiles, trucks, and tractors."

The items chosen for "farm expenditures" are not only those for which most farmers will have some kind of records, but are also among the most significant of farm expenses. For instance, considerable expenditures for feed are absolutely necessary for certain types of farming in certain parts of the country. Likewise expenditures for large amounts of fertilizer. Hired labor on the farm always presents a

serious problem—and never more serious than at the present time. The reports of the census will indicate the extent to which farmers in the various parts of the country depend upon hired labor.

In any agricultural census of the United States today it is essential to classify all farms by the tenure of the operator. Are we becoming a nation of farm owners, or a nation of farm tenants? Does the farmer still own and operate his farm? Is the absentee landlord on the increase? Is the farmer of the United States headed for farm peasantry?

As an aid in answering these questions and as a check to other items in the schedule, every farm operator in the United States is asked:

1. How many acres in this farm do you *own?*
2. How many acres in this farm do you *rent* from others?
3. Do you operate this farm for others as a *hired manager?*

If he answers question 1 only, he is an "owner." If he answers 1 and 2, he is a "part owner," owning part and renting part; if he answers only 2, he is a "tenant"; and if he answers only 3, he is a "farm manager." If the farm operator is a tenant (rents all the farm land he operates), he is classified as a share-tenant if he pays a share of the crops; a cash tenant if cash only is paid; a share-cash tenant if both share and cash are paid; a standing renter if a definite quantity of farm products is paid regardless of the yield; and a cropper if the landlord has furnished all the work animals. The tenant is also asked his relationship to his landlord.

The inventory of livestock on farms is one of the main features of the 1930 agricultural census. The term "livestock" is used by the census to designate (1) all common domestic farm animals, (2) poultry, and (3) bees. All the livestock on the farm whether owned by the farm operator or not will be reported by the farm operator on whose farm they are regularly located. Domestic animals of each kind will be classified according to age and sex. Cattle will be classified further as beef, or dairy, according to the principal purpose for which they are kept. The classifications for all domestic animals will show the kind, and the number by age and sex for not only the United States as a whole but also for each State and county.

These classifications form a statistical and an economic basis for study of vast importance because of the very intimate relation of the number and kind of animals to the food supply of the country. From the figures obtained, not only will the animal resources of the country be known at the present time, but comparisons can be made with the number reported in previous censuses running as far back even as 1850.

The livestock products to be reported in the 1930 census include milk, butter, wool, mohair, eggs, and honey. The questions relating

to dairy products will probably be the most difficult to answer. In some sections dairying constitutes an important part of the farming, and the farmer will answer the inquiries fairly well because his sale of milk constitutes an important part of his income. In other sections the production of milk and butter is given no special consideration.

At no census of agriculture have the field crops, vegetables, berries, and fruits been asked for in the detail carried on the 1930 farm schedule. Under the heading of "crops harvested on this farm in 1929," there are 5 questions on corn; 3 on sorghums; and 2 on sugar cane. For small grains there are 3 on wheat; 2 on oats; 6 on annual legumes; 8 on hay crops; 3 on grass seeds; 5 on miscellaneous crops; 14 on vegetables harvested for sale; 4 on berries; and 7 on orchard fruits; the quantity sold or to be sold is asked on 8 of the principal field crops and for 7 orchard fruits, nuts, and grapes. There are also 6 questions for forest products cut for home use or for sale. In general, the following inquiries are made:

For each crop: Acres and quantity harvested.

For principal crops: Quantity sold or to be sold.

For vegetables: Acres and value of vegetables harvested, and value of farm garden produce.

For fruits and nuts: Number of trees or vines not of bearing age and of bearing age, quantity harvested and quantity (on *fresh* basis) sold or to be sold.

Certain other inquiries on the farm schedule do not come naturally under any specific general head, but are classed as miscellaneous. Some of the more important of these are:

1. Mortgage indebtedness, if any, and interest, commissions, bonuses, etc., paid in 1929.
2. The total amount of taxes paid or payable in 1929 *on all property* of the farm which is owned and operated by the farmer, and the amount of taxes paid or payable on the *land and buildings*.
3. Acres in rotation pasture; acres of land terraced to prevent soil washing or erosion; and acres of land provided with artificial drainage by tile, ditches, etc.
4. Value of products purchased or sold to or through farmers' coöperative marketing organizations.
5. Facilities on the farm such as automobiles, motor trucks, tractors, electric motors, gas engines, combines, telephones, electric lights, and running water.
6. The acreage and quantity of each crop grown on irrigated land.
7. Amount received from sales by nurseries, seed farms, bulb farms,

and from flowers, plants, and vegetables grown under glass and flowers grown in the open.

8. Number of persons now residing on this farm who had moved *from* a city or other incorporated place during the last year, and the number of persons who moved from this farm during the last year *to* a city or other incorporated place.
9. Value of products of this farm in 1929, as follows:
   (a) Grains, cotton, tobacco, hay, vegetables, fruits, plants, flowers, and all other crops grown in 1929, which were or are to be sold or traded.
   (b) Value of livestock sold or traded in 1929.
   (c) Value of milk, cream, butter, butterfat, meat, poultry, eggs, honey, wool, mohair, and other livestock products sold or traded in 1929.
   (d) Value of forest products sold in 1929.
   (e) Estimated value of products of this farm in 1929 that were *used by the farm family*, such as meat, milk, poultry, eggs, honey, vegetables, fruits, firewood, etc.
   (f) Gross receipts from lodgers, boarders, and campers in 1929.

Sample copies of this schedule will be placed in the hands of three and one-half million farmers throughout the United States during the next two months. The farmer is sent this copy of the General Farm Schedule for his information in advance of the actual enumeration which will begin April 1, 1930. He is urged to discuss the questions on the farm schedule and the coming farm census with his neighbors.

There has never been at any previous census of agriculture so great a demand for detail in tabulation. Heretofore, the county has been the unit of tabulation. At the 1930 census, we hope to make the township or population minor civil division the unit. There are 55,000 minor civil divisions as against approximately 3,000 agricultural counties. Furthermore, there is a demand for the correlation of every item on the schedule, by six tenures, two colors, twelve size groups of farms, twelve types of farm and twelve groups of the value of farm products. Some of the more important inquiries, in addition to the correlations just named, are to be correlated further by six age groups, six occupancy groups, two occupations, seven tenures, and seven colors. It seems almost an impossible task for the Decennial Census period. We hope to do much, but just how much we will do will depend upon two things:

1. The completeness and accuracy of the individual farm schedules returned by the enumerators.
2. The time and money available to the Washington Office for this work.

SCALES FOR FAMILY MEASUREMENT

By Faith M. Williams

Ever since the United States Department of Labor began to measure food consumption by an exact, though admittedly arbitrary scale, it has been customary for students of standards of living to speak of food consumed "per adult male unit," but there has been very little use of scales for the measurement of the relative money value of all goods consumed by persons of different age, sex, and occupation. Such scales take the average money value of all the goods consumed by an individual of a given group (say the adult male at moderately heavy physical labor) as 100, and express the average money value of all goods consumed by individuals of other groups in terms of the figure utilized as a base.

We need such scales, in the first place, for the purpose of comparing the economic status of different families and groups of families. Then there is the problem of comparing the money value of goods actually consumed by a given group with the money value of a given standard of living. Even though we do not have enough physiological and psychological data on healthy conditions of living to make the formulation of a *minimum* quantity budget a reasonable project, it is quite possible, to make up a quantity budget representing a *certain level* of living for a family of a given composition, to price that budget, and to compare the money value of goods consumed by a family or group of families with the money value of the quantity budget. It is again necessary, however, to have some method of reducing the consumption of the families in question to a common basis for comparison. We are experimenting with a third use for an "all commodities" scale for measuring family consumption at the Bureau of Home Economics. We are attempting a detailed analysis of the expenditures of several hundred families in the hope of finding some significant material on the apportionment of family expenditures under certain conditions. We have found that the distribution of expenditures in different economic levels proceeds differently, when the expenditures are grouped according to value of goods consumed *per family*, or according to value *per adult unit*. I think that the grouping according to value of goods consumed *per adult unit* will prove to yield the more useful material, but the work has not proceeded far enough to make a final judgment possible.

Comparisons of the money expenditures of families of different

composition have been attempted in several ways,[1] but there are only three instances of which I know where an "all commodities scale" has been used for this purpose. Ernst Engel published such a scale in 1882, revised it in 1883, and utilized it in his study of Belgian family expenditures in 1895; the German Department of Labor used another such scale in 1907; and Sydenstricker and King compiled the third scale of this type in 1917. There seems to be a certain amount of confusion about these "all commodity" scales. A recent report of the International Labour Office [2] lists Engel's scale as being based on food only, and an Australian scale as "based on other groups of commodities as well as food."

The Australian scale to which reference is made was compiled by G. H. Knibbs in 1911. He says:[3] "It is not practicable to obtain results for sex and age classes in regard to expenditure on items other than food, owing to the difficulty of computing any satisfactory system of weights accurately denoting the extent to which the various items are used or consumed by persons in the various classes."

The pamphlet where Engel described his procedure in calculating his 1883 scale which is called *The Cost of Production of Human Beings* is very rare. Here he began with Prussian income tax figures for 1881 as revised by Adolph Samter. They are divided according to income classes, the number of tax payers and the number of their dependents being given for each class. He procured 20 working class expenditure records with an average annual income per person within a few marks of being the same as that shown by the income tax figures for 62 per cent of the Prussian population, and 5 middle class records with an income per person representative of about 7 per cent of the population. To these expenditure statistics he fitted a scale of relative annual expenditure per person. In commenting on his procedure Engel said:[4]

> We do not know what is the cost of birth, care, education, and culture for boys and girls, youths and maidens of different cultural groups during the years of their youth or learning period, until the beginning of their working or productive period. It is, therefore, necessary in order to carry the investigation further, having no other means of help at our command than this, in which repeated use will be made of higher mathematics, namely, to start out from a particular unit of value

[1] For recent experiments, see E. L. Kirkpatrick, "The Standard of Life in a Typical Section of Diversified Farming," *Cornell University Agricultural Experiment Station Bulletin 423*, 1923, p. 42; and Department van Landbouw, Nijverheid en Handel, Mededeelingen van het Centraal Kantoor voor de Statistiek Te Weltevreden, No. 60, inquiry into family-budgets in the Dutch East Indies during August, 1925, and the year 1926. Weltevreden, 1928 (table-headings are given in English as well as Dutch, and a summary in English is included in the report), pp. 109 ff.

[2] International Labour Office, *Methods of Conducting Family Budget Inquiries*, Studies and Reports Series N, No. 9, Geneva, 1926, p. 48.

[3] G. H. Knibbs, *Inquiry into the Cost of Living in Australia 1910–11*, Australia, Bureau of Census and Statistics, 1911, pp. 18 ff.

[4] *Der Kostenwerth des Menschen*, Berlin, 1883, p. 55.

> which comes the closest in the greatest number of cases to the actual situation, and to allow it to grow regularly and proportionately. In this case the starting point is birth. In accordance with this plan, we place the expense already caused by a young citizen of the earth at the moment of his birth as 100, and we assume that the expense is increased by ten such value units every year until some time between twenty and twenty-five years of age.

Engel discussed the scale before the International Institute of Statistics and said,[1]

> I do not pretend that the figures of the scale could not be contested. I admit the same for the reasons which I have explained in my brochure on the cost of production of man, but they are sufficiently accurate for the rôle they are called upon to play here. It is then the average sum of annual expenses for consumption which determines the rank of consumers.

In the 1895 Belgian study Engel did not give any clue as to the methods he had used in calculating the unit which he now called a "Quet" beyond referring to the 1883 pamphlet, but he published a table showing side by side his expenditure scale and some figures from Quetelet and others giving human growth in body weight per centimeter of height. Apparently he made this comparison because he thought that the need for food would increase in accordance with growth in weight, and because he had found that about 62 per cent of working class family expenditures were devoted to food purchases. He commented on the fact that the expenditure scale did not proceed at exactly the same rate as the weight table but that there was a close correspondence between them. We may regret that Engel's best-known work is not self-explanatory, but when we remember that he was 74 years old when he completed the Belgian report and that he had been working alone for several years, we cannot be surprised that he did not repeat what he had published elsewhere.

The "all commodities" scale used in the German cost of living study of 1907 loses in value, because, as far as I can find out, the directors of the study did not give the basis on which it was computed. A very low figure is assigned to the young children, 10 per cent of that assigned to the adult male, but no definite explanation is given for the change from the Engel scale.

When Edgar Sydenstricker and W. I. King computed a new expenditure scale in connection with a study of disease prevalence in South Carolina, they collected 140 total expenditure records and 1500 food expenditure records. They defined their unit as follows:

> The unit in this instance may be defined as the gross demand for articles of consumption having a total money value equal to that demanded by the average

[1] *Bulletin de l'Institut International de Statistique*, Tome II, 1ère livraison, 1887, p. 70.

male in that class at the age when his total requirements for expense of maintenance reaches a maximum. The unit may be denominated the ammain.[1]

The question of the future use of the ammain scale was raised when it was presented. The authors said:[1]

> Although the ammain and fammain (food) scales here presented are probably fairly representative of expenditures for persons of different ages and sexes among the cotton mill workers in South Carolina, it does not follow that the same relative expenses of maintenance would be strictly applicable to other classes of workers. The existence of such similarities or differences can be determined only by investigation.

A study of the money value of adequate diets in Central New York State seems to indicate that children in the South Carolina mill villages were not adequately nourished and that the relation between food expenditures for parents and children would be different in groups where more attention is paid to child care than is possible in the families of southern factory workers.[2]

If the ammain scale should be utilized in some new study to measure family size, it would be necessary to determine whether there has been a realignment of retail prices which would change the relationships found to be true in South Carolina in 1917, and whether household organization in the new community is the same as in the one where this expenditure scale was made. The relationships between expenditures for mother, father and children, will be different if the mother works in the factory all day or if she works at home.

When it seems desirable to compute new scales for measuring family expenditures in some situation where the ammain scale does not apply, it will become necessary to decide whether the investigator shall proceed, as Sydenstricker and King did, to compute scales which will fit the average behavior of the whole population of a given community as nearly as possible, or whether a certain group in the community shall be selected. If it is desired simply to compare one family with another or one group of families with another a scale representing the average expenditure relationships in the community would be quite satisfactory, but if it is desired to compare the average money value of goods actually consumed with the money value of a quantity budget representing a certain level of living, then it would seem desirable to select the families on whose experience the scale is to be made up by certain objective standards. We do not have many criteria which can be scientifically applied to measure all the conditions upon which healthy living depends, but we can at least isolate among our records those families whose diets are adequate in providing them with enough

[1] This JOURNAL, September, 1921, pp. 852 ff. [2] *Ibid.*, 1929, p. 288.

energy, protein, calcium, phosphorus and iron. Within a short time we should be able to obtain from the sanitary engineers, urban and rural, criteria for determining minimum standards for sewage disposal. When we have separated the expenditures of families whose diets come up to the minimum for adequacy, and whose sanitary arrangements also come up to the minimum requirements for health, we can compute a new scale on the basis of their experience to use in measuring size of family. It will thus be possible to be somewhat more accurate when we are attempting to use figures on family expenditures for the purpose of measuring standards of living.

If a large enough body of figures becomes available it will be interesting to compute some scales showing how expenditures for persons of different age and sex vary with size of family. We will then be able to answer the question "How great is the economy in expenditure per person resulting from the large family?"

Enough work has been done with scales for the measurement of the relative money value of all the goods consumed by persons of different age, sex and occupation to prove their value in analyzing expenditure data, but more work is necessary in the near future if there is to be a complete understanding of the uses and the limitations of such scales.

SOME DEVELOPMENTS IN THE TECHNIQUES OF STUDYING CONSUMER DEMAND

By Warren C. Waite

The term consumer demand is restricted in this discussion to the demand at retail prices for a particular product in a designated market by the final consuming units of that market. There are three things which it is important for us to know about this demand. First, we wish to know the shape or character of the curve at a particular period of time, the elasticity of demand. Next, we wish to know how this curve shifts its position and shape from one period of time to another, whether this change has a trend, a seasonal variation, is related to unemployment, and so on. Finally, we wish to know how particular consumers are related to this demand curve. We would like to be able to determine a demand curve for each important class of consumer in the market, in short present a demand surface for the market as well as a single curve. Technical factors, however, will usually seriously limit our ability to do this and we will ordinarily be forced to content ourselves with determining the reasons for variation in the rate of consumption among consuming units at a given period of time. For example, suppose our demand curve is an expression of per capita consumption of the entire market at various prices. We wish to know at particular prices the different per capita rates of the important groups of consumers who together produce this market rate, and the causes for differences among them.

There are two general methods of approach to these problems. The first is by obtaining a record of the purchases of a group of consumers over a period of time and the other is by securing answers to a considerable number of questionnaires submitted to consumers. The ideal way would be to have consumers keep a complete record of their purchases and prices over a considerable period of time. Dr. Hoyt has followed this procedure in some of her studies. It is difficult, however, to induce any considerable number of typical families to keep accurately such records and the procedure will be impossible in most cases. The nearest approach will be in tracing deliveries to or sales from the marketing units in one particular market. Even this will be impossible for certain types of products and classes of consumers for the reason that portions of these products may never appear in the market as units to be sold, such as home-grown produce, or dairy products consumed on farms. Knowledge of these quantities can be

obtained only by directly questioning the consumers. The questionnaire of individual consuming units will also usually be necessary for determining the different rates of consumption by consuming units of particular characteristics, although we may obtain some approach to this problem where we are able to relate types of consumers to marketing units. We will seldom be able, however, to secure a complete description of our consumers by this latter method. It thus appears that, to secure the statement we have outlined as desirable, we must use both the method of tracing deliveries and of submitting a questionnaire to consumers. We need the former to determine our demand curve and the latter to secure a statement of the variation and causes for this variation among consuming units.

I will simply enumerate the major problems which arise under each type of study and where possible mention techniques which have been employed in meeting these problems. The first major problem which arises in the tracing of deliveries or sales to consumers is that of associating the consumers and deliveries or sales. Ordinarily, this will be upon an area basis, and will involve association in the entire market or for particular outlets or sales agencies. We may illustrate the problem in the case of the total market by milk. The Bureau of Agricultural Economics obtains from some 500 cities estimates by Boards of Health of the consumption of milk and population of those places. When these data are arranged by size of city the per capita figures show a quite regular progression, the larger places reporting larger per capita consumption than the smaller places. Several factors aside from characteristics of consumers may produce the differences. Dealers in the larger places may serve consumers in regions outside the corporate limits of the place and these may be under-estimated by the Boards of Health. This under-estimate would probably be greater in large than in small cities. Also in the smaller places there is likely to be a greater delivery of milk by small producers or those owning cows within the corporate limit than in the larger places. Such deliveries might not be sufficiently estimated by the Boards of Health. Both of these would operate to produce a greater estimated per capita consumption in the large than in the small places. Similar problems arise in every study. There are no special techniques involved, the accuracy depends upon the diligence and knowledge of the investigator.

These problems become more acute when we deal with particular outlets. In only exceptional cases is it possible to associate an actual number of consumers with a particular outlet. In the case of sales by stores, such as in the demand study which the Bureau of Agri-

cultural Economics is making with a group of chain stores in Metropolitan New York for butter and eggs, the number of consumers trading at these stores is unknown. This would not be serious if the number of customers remained the same during the period of our study. There may be considerable shifting of customers among stores, however, and a movement, largely seasonal, of consumers in and out of the trading area. We are endeavoring to eliminate the first of these difficulties by including all the chain stores in the particular trading area, probably a group of six or eight and selecting areas where there are few stores other than chain stores. The second difficulty we will attempt to make allowance for by adjusting for number of customers on the basis of fluctuations in the total sales of the stores. The Division of Dairy and Poultry Products of the Bureau of Agricultural Economics, in its study of the effect of consumer education in the meaning of the United States grades for eggs when such eggs are available to consumers along with eggs as ordinarily sold, is adopting the device of check stores. These check stores are stores in which eggs are handled in the ordinary manner. Some check stores are located near the laboratory stores for the purpose of establishing shifts in consumers and some in other sections to establish general changes in demand, which might otherwise inadvertently be included in the analysis.

The second major problem is that of the designation of the characteristics of consumers by areas or outlets. If there is a distinctive and fairly uniform type of consumer in particular areas we can determine demand curves for this type by studying the sales in each area. Certain characteristics of the consumer appear capable of classification on an area basis, chiefly income and nationality or race. In both the study of the demand for butter and eggs in New York and our milk survey in Newark and neighboring New Jersey towns we have attempted such a classification. In New York we matched the data on prevailing incomes, on nationalities, and locations of chain stores to select 15 areas around groups of chain stores distinctive as to income and nationality or race. For example, there are 4 areas of native whites of different incomes, 4 areas largely Jewish in different income groups; in all, 6 groups of races and nationalities and 5 income classes are represented. From the records of the chain stores in these areas we hope to be able to establish demand curves by nationalities or races and income groups.

In the survey of consumers by the questionnaire method there are two principal problems, the selection of the consumers to be interviewed and the accuracy of the replies. In the selection of our con-

sumers we must determine the type and number of each class to be interviewed. Our type will naturally be determined by the consumer characteristics which we believe important factors in the consumer demand for the particular product. In our consumer survey of milk consumption in Newark and neighboring New Jersey towns we decided upon race or nationality, size and composition of family and income as the probable important factors. Race or nationality and income we endeavored to secure by our selection of areas, expecting to get a sufficient variety of family sizes and compositions to permit analysis upon that basis. The areas were selected in a manner similar to the New York study, except that for Newark the Bell Telephone Company was able to supply us with a rent distribution for each block of the city from which we inferred incomes. Needless to say a question on income was included on the questionnaire, the other information simply serving to locate the probable incomes for us. The question of nationality is not solved merely by the entry of, say, Italian on the schedule. The problem remains of how long the family can properly be considered as retaining the characteristics of Italians with regard to milk consumption and when and under what circumstances they take on the characteristics of the native whites. We have endeavored to throw some light on this situation by securing a statement of the generations which the family has been in this country. Thus we will be able to compare the consumption of the class during successive generations.

There are little data available to guide us on the question of the number of consumers to be included in each of our income and nationality classes. It is obvious that if we knew the standard deviation of the consumption of the particular product in similar studies elsewhere and could arrive at the accuracy desirable in our mean we could come close to estimating the number of cases we would require. In the absence of such data we have been forced to content ourselves with making sure that we had at least 25 to 50 cases in each of our important cross classification of incomes and nationality. This figure was, of course, arrived at by comparing the rates of increase in accuracy following additions of cases, and the rates of increase in number of cases.

Finally there is the problem of whether the survey omits important classes of the community. Our milk survey, for example, was taken during the day and we thus missed those whose homes were not sufficiently established so that someone was maintained in the household throughout the day. Young married couples without children, for example, both may work. Whether this class differs materially in

consumption habits from the families included in the survey needs to be determined if we wish to generalize regarding all in the area. We expect to establish the importance of the omitted class in our particular study by a comparison with the deliveries by milk companies, which will be mentioned later.

The relationship between income and consumption, although it may not yield us the conventional demand curve is nevertheless of great importance. It can be carried much further than the ordinary, wealthy, middle and poor family classification by more specific data regarding incomes. We will then be able to calculate income-consumption coefficients similar to our elasticity of demand coefficients. There will be this difference, our elasticity of demand tells us the effect of variations in the price of the particular product, other things remaining the same, while, if we assume our classes of consumers are alike except for income, our income-consumption coefficient tells us the reactions of consumers to lower or higher incomes. We may thus throw some light upon the effect of employment and wages upon the consumption of specific products.

A knowledge of the accuracy with which consumers answer the questions in a survey is important in telling us the accuracy and reliability of the consumer survey as a means of obtaining information on consumer demand. We may obtain such information by checking surveys against other records or by means of duplicate surveys. We are experimenting with both. The consumers in our Metropolitan study were asked the milk company from which they purchased. From the books of the principal dealer in the area we obtained a record for an entire year of the purchases of these families and in addition the sales to all families in the area from which our sample was drawn, whether we had records from these families or not. We are thus able from the records which we match with the records of the milk company to tell how accurately these consumers were able to report their purchases. We also expect by comparing the milk company reports which we have matched with our records with all the milk company records from the area to learn something of the importance upon our results of the omitted class which was mentioned earlier. A significant difference in these two groups would indicate that class to be of importance. The comparison of the reported consumption of our matched families at the time of our record taking with their consumption at other periods of the year will show us how much our averages might have differed if we had taken the survey at a different time of the year.

In one of the townships included in a survey of the consumption of

dairy products in rural areas, we have a duplicate survey of the township some six months later. The comparison of these surveys is throwing much light on the adequacy of the questionnaire as a means of obtaining information of this type, as well as the reliability of this particular survey itself. There are 90 families for which we have records, both surveys. We are comparing the answers between the matched questionnaires item by item in this group. To indicate the nature of the findings, the most striking item is the income. While the average of the reported incomes differs by only $98 an amount within the range of the possibilities of simple sampling, yet the correlation between these items is only .35.

There is need for more concern over the results of the survey method than is generally felt. Because it is widely used we jump to the conclusion that the method is good. We need to establish more definitely its reliability and place in the study of consumer demand.

GENERALIZED MULTIPLE CORRELATION ANALYSIS OF ECONOMIC STATISTICAL SERIES [1]

By Max Sasuly

The essential characteristics of economic variables recorded as "time series" can be disclosed effectively only by a study of their interrelations. This idea has been formulated with particular clarity by Cournot (1838), and subsequently by others, notably Walras, Pareto, and Fisher (1892).[2] For general practical purposes the interrelation of a few of the principal variables is sufficient. This is apparent in the pioneer work from Yule (1895) and Hooker to Moore (1917).[3] It is strikingly shown in the recent fruitful development of this pioneer work, especially in the field of commodity price analysis and "forecasting."[4]

However, at best, the solution of the Cournot problem by the current methods of multiple correlation is an approximation which is often inadequate in problems where the abundance of statistical data justifies more precise results. In the following, generalizations of multiple correlation technique are developed that extend the scope of present methods.

The methods of multiple correlation currently used involve implications of probability theory that are of uncertain significance and often irrelevant in economic time series.[5] Furthermore, the relations of the variables in mutual regression equations are essentially non-commutative (except in the unreal case of perfect correlation). In the case of two variables, P, Q, as in Chart I, there are two regressions, P on Q and Q on P, differing in mutual implication to the extent that r differs from $1/r$. In the case of multiple correlation of m variables, there are m multiple regression equations, mutually incompatible. This entails an m-fold ambiguity that does not appear resolvable by any theory at present available. Finally, the multiple correlation analysis currently employed yields only "static" relations. The regression equation expresses a relation between the variables that is independent of any

[1] Progress report of sundry studies in statistical technique at the Institute of Economics of the Brookings Institution.

[2] A. Cournot, *Theory of Wealth*, 1838 (Bacon translation, 1927, p. 127); Irving Fisher, *Mathematical Investigations in the Theory of Value and Prices*, 1891 (reprinted, Yale University Press, 1925), pp. 63, 64.

[3] G. U. Yule, *Theory of Statistics* (ed. 1911), Chap X. H. L. Moore, *Economic Cycles* (1914), p. 82; *Forecasting the Yield and Price of Cotton* (1917).

[4] See sundry papers by M. Ezekiel, B. B. Smith, H. R. Tolley, and other economists of the Bureau of Agricultural Economics, United States Department of Agriculture.

[5] K. Pearson and E. M. Elderton, *Biometrika*, Vol. 14 (1923), pp. 281–309; G. U. Yule, *Journal of the Royal Statistical Society*, January, 1926; E. Woolard, J. T. Walker, *Monthly Weather Review*, March, 1927 (pp. 107–112), October, 1927 (pp. 459–461).

point in the time interval studied. Thus, in Moore's attempted solution of the Cournot problem, a multiple regression equation is derived for, say, the price, P_1 as a function of several related prices and quantities ($P_2, P_3, \ldots, P_n; Q_1, Q_2, \ldots, Q_n$).[1] This presumed relation is derived from data covering perhaps twenty or thirty years, yet t is altogether absent from the equation. It thus implies that the dependence of P_1 on the related P, Q variables is in the fixed form given by the equation *throughout the entire period studied.* This is manifestly not a "dynamic" economic relation.

It will be shown how the Cournot problem may be formulated so as to overcome the above limitations to a considerable degree. This is effected by certain extensions of correlation theory applying to economic statistics, primarily from the standpoint of least square approximation of arbitrary functions by other assigned functions.

EXACT FORMULATION OF THE REGRESSION EQUATION

Consider the case of simple correlation of two variables, such as the time series P, Q shown in Chart I.[2] When these variables are reduced to the "normal" form of the correlation algorithm, *i. e.* to "standard" deviations from their respective means, r may be given in a form having a very significant geometrical meaning.

$$r = 1 - \tfrac{1}{2}\frac{1}{n}\sum_{i=1}^{n}[P_i - Q_i]^2. \qquad (1)$$

This form, which appears to have been first derived by Huntington (1919) and Dunham Jackson (1924),[3] expresses r in terms of the "discrepancy," v, between the two series superimposed as shown in Chart I. This v is not to be confused with the one representing the deviations from the regression lines in the usual scatter diagram, as shown in Chart I. The discrepancy residuals v when plotted to the same t-axis as the P, Q variables may be considered as an auxiliary function $f(t)$. It is seen as once that the *exact* relationships holds:

$$P = \pm Q + f(t), \qquad r \gtrless 0.$$

To facilitate analysis a convenient expression can be fitted representing the locus $v = f(t)$ as closely as is feasible. The above exact equation corresponds to the customary non-commutative regressions

[1] H. L. Moore, "Elasticity of Demand, etc.," this JOURNAL, Vol. 18 (1922), p. 13; *Synthetic Economics* (1929), pp. 61, 99, 127.

[2] The data are the annual per capita supply and deflated price of sugar for the years 1890–1914; the data are "smoothed" slightly.

[3] See references in H. L. Rietz, *Handbook of Mathematical Statistics* (1924), p. 125; *American Mathematical Monthly*, March, 1924, p. 117; H. L. Rietz, *Mathematical Statistics* (Carus Monograph, 1927), p. 84.

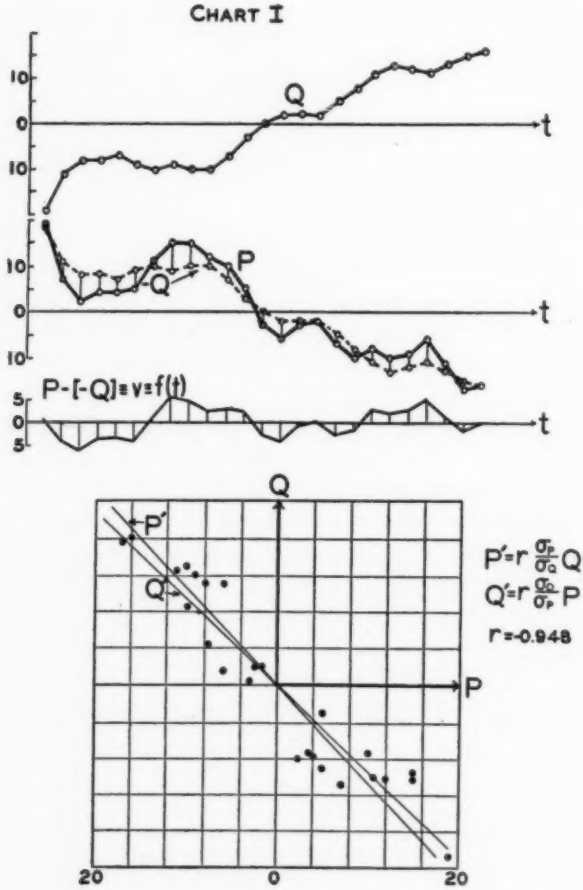
$$P' = r\frac{\sigma_P}{\sigma_Q}Q, \qquad Q' = r\frac{\sigma_Q}{\sigma_P}P.$$

In the case of any time series data X, Y, the exact equation is

$$\frac{X-a}{\sigma_x} = \pm\frac{Y-b}{\sigma_y} + v, \qquad r \gtrless 0, \tag{2}$$

where a and b are the average values of X and Y respectively and σ_x, σ_y are the corresponding standard deviations. This exact equation corresponds to the non-commutative regressions $X' - a = r\frac{\sigma_x}{\sigma_y}(Y-b)$ and $Y' - b = r\frac{\sigma_y}{\sigma_x}(X-a)$.

CHART I



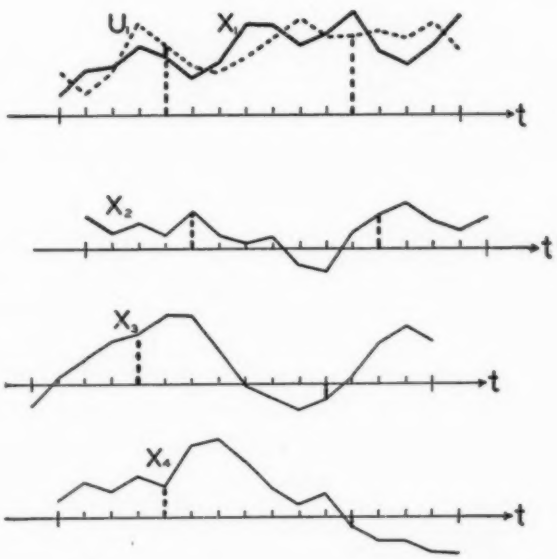
EXACT FORMULATION OF THE MULTIPLE REGRESSION EQUATION

The derivation of the multiple regression equation on the basis of least squares has been well known for some time.[1] The regression of a variable X_1 on several others, X_2, X_3, X_4 (all to "normal" scale), is in essence a unique linear combination

$$U_1 = a_2X_2 + a_3X_3 + a_4X_4$$

"best" fitting X_1 by the criterion of least squares during the period studied. The values of the X_i may pertain to the time $t+\tau_i$, indicating

CHART II



an appropriate lag for each X_i, as shown in Chart II. The closeness with which U_1 approximates X_1 is measured by r, their coefficient of simple correlation.[2] Consequently the regression equation for the several variables can be made exact, as in the case of two variables, by introducing the locus of the residuals, $v = f_1(t)$, between corresponding values of U_1 and X_1. Thus there is obtained the exact equation

$$X_1 = a_2X_2 + a_3X_3 + a_4X_4 + f_1(t). \qquad (3)$$

[1] G. U. Yule, *Journal of the Royal Statistical Society*, Vol. 60 (1897), p. 812; *Proceedings of the Royal Society*, London, 60 (1897), p. 477; M. Ezekiel, this JOURNAL, December, 1924, p. 435.

[2] This r is the corresponding coefficient of multiple correlation, R; cf. Rietz, *Handbook*, p. 139.

DYNAMICAL REGRESSSION COEFFICIENTS

The regression coefficients a_2, a_3, a_4, are the "weights" with which X_2, X_3, X_4 in combination determine U_1 rigorously and, perforce, X_1 approximately. If by economic analysis X_2, X_3, X_4, may be considered the principal forces determining X_1, the coefficients a_2, a_3, a_4 measure the relative weight attaching to each X_i in the composite determination of X_1 during the period studied.[1] The residual $v=f_1(t)$ in the exact equation then measures the forces, other than X_2, X_3, X_4, of which it is not possible or feasible to take explicit account in the equation.

CHART III

Evidently it is a closer approximation to actual conditions to consider the weights a_i as varying in the course of the period studied. Thus the variable X_3 may exert its influence on X_1 only during a certain portion of each year. A function of time such as $\sin^8(2t)$ would represent such an intermittent influence, as shown in Chart III. It is best then to represent the regression coefficients as functions of time, $a_i(t)$. It is desirable to have the parameters in the variable regression coefficients in linear form; for example

$$a_i(t) = a_0 + a_1 t^2 + a_2 \cos^4(2t). \tag{4}$$

The solution of the normal equations entails only a moderate increase in labor over the case where the a_i are assumed constant.

DIFFERENTIAL EQUATION MULTIPLE REGRESSION

The single algebraic equation of multiple correlation, even as extended above, does not completely express all the interrelations of the variables studied. Following the analogy of the methods used in the physical sciences, a *system* of equations may be expected to express the relations more adequately. In particular, the system should involve the *derivatives* of the variables as well as the variables themselves. This idea has, of course, long been utilized in theoretical studies, at

[1] M. Ezekiel, "Factors Related to Lamb Prices," *Journal of Political Economy*, 35, April, 1927, p. 254.

least since Cournot. But recently it has been found fruitful also in practical economic analysis.

In a number of studies during the past six years Fisher has proved conclusively that fruitful relations between economic series may be disclosed by studying the *rate of change* (derivatives) of the data as well as the data themselves.[1] Subsequently other investigators have used derivatives of time series effectively in economic studies.[2]

The derivatives of economic data can be readily computed by well known graduation formulas. To a small group of a series of "equidistant" items $y_1, y_2, y_3, \ldots$ an appropriate parabolic arc may be fitted. The derivative for any y is considered given by the tangent to the fitted arc at that point. Thus there may be constructed the series of derivatives $\frac{dy_1}{dt}, \frac{dy_2}{dt}, \frac{dy_3}{dt}, \ldots$.[3]

Corresponding to the individual items $X_{i1}, X_{i2}, \ldots, X_{in}$ of the variables X_i considered above, there may thus be derived the items

$$\frac{dX_{i1}}{dt}, \frac{dX_{i2}}{dt}, \ldots, \frac{dX_{in}}{dt}; \qquad i=1, 2, 3, 4.$$

Then from the two sets of variables, X_i and $\frac{dX_i}{dt}$, there may be obtained the system of exact multiple regression equations

$$\left.\begin{aligned}
\frac{dX_1}{dt} &= a_{11}X_1+a_{12}X_2+ \ldots +a_{14}X_4+f_1(t),\\
\frac{dX_2}{dt} &= a_{21}X_1+a_{22}X_2+ \ldots +a_{24}X_4+f_2(t),\\
&\ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots\\
\frac{dX_4}{dt} &= a_{41}X_1+a_{42}X_2+ \ldots +a_{44}X_4+f_4(t).
\end{aligned}\right\} \qquad (5)$$

The solution of this system is furnished by methods pertaining to one of the most adequately developed domains in modern mathematics, the field of linear differential equations.[4] When the a_{ij} are constants the solution for each X_i is a function of t, and of certain parameters λ_j. With $i=1, 2, 3, 4$,

[1] Irving Fisher, this JOURNAL, December, 1923, p. 1024; June, 1925, p. 179; *The Theory of Interest* (in press), Ch. XIX.

[2] B. B. Smith, this JOURNAL, December, 1927, p. 455; L. Amoroso, *Giornale Degli Economisti*, February, 1929.

[3] See, *e. g.*, M. Sasuly, this JOURNAL, March, 1930.

[4] F. R. Moulton, *Periodic Orbits*, Carnegie Institution Pub. No. 161 (1920), Ch. I; *Modern Theory of Differential Equations* (in press).

$$X_i = A_{i1}e^{\lambda_1 t} + A_{i2}e^{\lambda_2 t} + \ldots + A_{i4}e^{\lambda_4 t} + F_i(t). \qquad (6)$$

The parameters involve the regression coefficients a_{i1}, a_{i2}, a_{i3}, a_{i4}, and the $F_i(t)$ involve the "residual" functions $f_1(t)$, $f_2(t)$, $f_3(t)$, $f_4(t)$, and also the a_{ij}. It is necessary to determine four "initial conditions," or constants of integration, to evaluate the A_{ij} so as to make the solution complete. These can be readily supplied, say, by postulating that the average of each computed X_i shall be equal to that of the original X_i.

In this form the solution for X_i is truly "dynamical." Each X_i is expressed as a function of time and parameters that are derived from the mutual interrelations of all the X_i. Those interrelations that are given by the $f_i(t)$ and thus not known explicitly enter the solution separately. Their uncertain effect is clearly measureable against the portion of the solution expressed in known terms.

If it is desired to express X_i in relation to X_j, as in a supply-demand-price relation, the usual Marshall expressions can be written down at once as *functions of time*,

$$\frac{dX_i}{X_i} \Big/ \frac{dX_j}{X_j} = \left(\frac{dX_i}{dt} \Big/ \frac{dX_j}{dt}\right)\left(\frac{X_j}{X_i}\right) = \phi_{ij}(t).$$

If it is desired to express X_i explicitly in terms of X_j, during any part of the period studied, it is merely necessary to eliminate the time t, considered in this case as a parameter. The problem is identical with that of solving for the orbit of one of a group of interacting planets. The coördinates of motion are obtained by solving the system of differential equations expressing the mutual interactions. Eliminating the parameter t from the coördinates yields the equation of the orbit.[1]

[1] F. R. Moulton, *Introduction to Celestial Mechanics* (1914), pp. 299–304.

STATISTICAL ANALYSIS IN FOOD COMPOSITION STUDIES

By Charlotte Chatfield

Data on the chemical composition of foods are being studied by the Bureau of Home Economics, U. S. Department of Agriculture, for the purpose of issuing tables to revise those now in use. This work is being done to meet an increasing demand which comes principally from doctors, nutrition specialists, teachers, institutional managers, social agencies, and from producers of food materials. The analyses on which the study is based have been collected from the results of many different types of investigations, including ones in horticulture, agronomy, plant physiology, and animal nutrition. Laboratories concerned with regulatory work or with the manufacture of food products have also contributed analyses.

On account of the variability in composition of the foods themselves, a careful statistical study of the data is necessary. Since the original selection and handling of the chemical sample is usually beyond the control of the present investigation, the complexity of the study is greatly increased. Differences that arise from the way the sample was chosen or from the laboratory treatment are superimposed on actual differences in the food materials. Furthermore, the chemical samples are too small for most foods to give a wholly satisfactory picture of their composition; and the collection of further data is strictly limited on account of the cost. Sampling studies are very much needed, but the very conditions which necessitate such an analysis interfere to a marked extent with the application of statistical methods.

Enormous variations in the composition of meats are illustrated in one of the publications resulting from this investigation. Sampling and correlation studies in the work on meats have cleared up much of the former confusion. The close relationship that has been shown to exist between the fat content of a carcass of beef, pork, or lamb and the entire composition of each of the cuts has given a key to the problem. In some meats, particularly beef, the commercial grade, too, has been found to be closely related to fatness. These facts provide a basis for reducing some of the large errors in estimating the composition of meats in the diet.

With the plant foods, too, studies of the nature of the variation between samples have helped materially in preparing tables. From the standpoint of applying statistical formulae the chemical samples in the fruits and vegetables, for example, are insufficient and not well

selected. This study has been made, however, with a full recognition of the limitations of such an analysis, and allowance has been made for the way in which the samples were selected. Tables on fresh fruits have been issued and the data on fresh vegetables are now being summarized.

As the new average figures are being issued, there is for each food some indication of the extent to which the composition varies in individual samples. The person who uses them may know, then, about how far he can rely on them to represent his particular conditions. Since the variation is often wide, the averages may be only very rough estimates of the composition of a given individual sample, but, as averages, they are probably more reliable than any that have been available heretofore.

AGRICULTURE IN THE POST-WAR DECADE

By Louis H. Bean

The agricultural industry in the United States during the post-war decade may be examined from an internal standpoint for the significant economic changes and shifts that have taken place and are still going on within the industry. Or, it may be reviewed more briefly from an external standpoint for the significant recent changes in net aggregate production, prices and income. If one were to review the changes that have taken place since the War within the industry, it would be necessary to take into account such tendencies as the following: A gradual decline in the number of farms; a reduction in the number of livestock, particularly horses; an increased use of machinery; a decreased total acreage in major crops between 1919–1924 and an increase during the past five years; an increase in the output per farm due largely to more efficient utilization of machinery, labor and feed and a westward shift in crop production to more fertile areas; a marked expansion in the production of truck crops, citrus fruits, and poultry and dairy products, and a downward trend in the production of grains for sale; a continued decline in the value of farm lands with some indications of improvement in the past year or two and a falling off in number of farm bankruptcies and foreclosures. Looked at externally, agriculture may be best described by considering the major changes in its aggregate production and its income for that production, resulting from the variations in prices and demand. The following comments deal with agriculture in the post-war decade from this second standpoint only.

The past decade has shown three distinct trends in gross income per farm. In the first three years 1919–1921 the gross income per farm declined from about $2,500 to nearly $1,400, gross income being defined here as the value of farm products sold plus the value of farm products produced and consumed in the farm home. In the next four years it recovered to nearly $2,000 per farm and has since remained under that figure, or about $1,950. This is approximately the average level between the very good season of 1919–20 and the very bad year of 1921–22. In terms of income, whether gross or net, the last half of the post-war decade may be characterized as a period of stability, after a period of considerable instability. These variations in gross income have been due of course to variations in prices, production and demand, but the nature and extent of the fluctuations in these three elements of farm income have not been the same throughout the post-war

decade. To what extent have prices, production and demand contributed to the establishment of that stability in income?

Following the great decline in prices to low levels in 1921, agricultural prices tended upward to 1925, and have since then fluctuated about a horizontal trend, but considering the past eight years, there has been a definite upward trend in prices received by farmers. In 1919 and in 1920 prices received by producers were nearly 210 per cent of the pre-war prices; in 1921 and 1922 they averaged 120 per cent; and in the past three years they have averaged 130–140 per cent of pre-war levels. In contrast it may be pointed out that non-agricultural prices recovered more quickly in 1922 from the depression of 1921 but have since then tended downward. From 1919 to 1921 it may be said that agricultural prices were dominantly influenced by the financial and business conditions which affected all other prices. Between 1921 and 1925, they may be said to have been influenced by a recovery in the buying power of domestic consumers and of our foreign markets, and that in recent years they have responded mostly to variations in agricultural production in the United States, except in the case of those commodities, like wheat and flax, the prices of which have responded also to production abroad.

Taking into account all farm products produced for sale or for consumption in the farm home there has been a rather marked increase since 1919–1921, the index of net agricultural production has risen from around 90 to 110. This increased output is due largely to the marked expansion in dairy and poultry products, in fruit and truck crops and in the recovery in cotton output from the low level of 1921. Compared with the 20 per cent increase in the total net agricultural output in the post-war decade, dairy and poultry production increased about 40 per cent and truck crops, about 70 per cent. The increase in production in the past five years has not been as great as in the preceding five years.

The expanding output of dairy and poultry products has been accompanied by a relatively higher level of prices in recent years than that which prevailed during the first part of the past decade. This may be taken as evidence of an increased demand for these products. To some extent there has also been an increased demand for meat animals. Taking all farm commodities into account, it appears that an increase in the aggregate production in any one year (as in 1926 or 1928) has produced a corresponding decrease in the level of prices received by farmers, and that a decrease of production in any one year (as in 1927 or 1929) has produced a corresponding increase in the level of farm prices relative to the general commodity price situation. But, for the same volume of production in the recent years, the level of

prices received by farmers after taking into account the general commodity price changes has been higher than in 1920–1922. This increase in demand is in part a reflection of the growing population, the general recovery in domestic buying power from the depression years of 1921 and 1922 and of the slower rate of increase in farm output as compared with that of non-agricultural products. It may be noted, with reference to the latter factor, that in the past decade the increase in non-agricultural production appears to have been about twice as much as that in farm production.

Reviewing the trend in demand since 1919, there appears to have been a greater stability in the past five years than in the preceding. This, and the slower rate of increase in total farm output in the past five years appear to be the chief factors in the recent stability in farm income.

The recent upward tendency in agricultural product prices relative to non-agricultural prices appears to be a continuation of a long time tendency. If we take the relation that existed in the five pre-war years between farm product prices and non-agricultural prices as a standard of comparison, as 100, it appears that in the period 1875–1880 the relation is expressed by an index of 70, increasing gradually with fairly regular cyclical fluctuations to 100 in 1910–1914, and to 112 in 1918–1919. From that high point the relative level of farm product prices dropped to about 90 in the period 1920–1923 and the recent recovery has restored it to a level above the long time upward trend, or about 112 in 1928 and 1929 compared with the same level in the war years. Of course, if history repeats itself, and agricultural production continues to increase more in line with the growth of population, while industrial production continues to expand at a more rapid rate, as it has in the past 55 years, it is quite likely that the long time upward trend in the relative position of agricultural prices will continue. It is to be observed finally, that such relatively high levels of agricultural prices as have existed in 1928–1929 and 1918–1919 have in earlier periods been followed by temporary recessions lasting several years. A recovery in business activity in the next year or two tending to strengthen non-agricultural prices, and an increase in agricultural production tending to lower agricultural prices might easily create such a temporary recession in the ratio of farm product to non-agricultural prices.

AMERICAN LABOR SINCE 1920

By Leo Wolman

Compared with the present state of many quantitative economic series, the statistics of labor are still crude and inadequate. In some cases, where indispensable light would be thrown on a fundamental problem by the use of simple measures, they are found not to be available. One key to the secret of the high wages prevailing in this country since 1920 could unquestionably be found by the addition to our present series of wage statistics of one or two simple and obvious new measures of wages; and the door to the whole problem might be easily unlocked by the preparation of measures of productivity that are a bit more refined than those we now have. Meanwhile, in the important fields of wages, hours of labor and trade unionism, the rapidly growing collection of data yields suggestive side-lights both on problems of economic theory and of measurement.

All series of wage movements in manufacturing industries show a rise in hourly earnings following 1922, their maintenance on a higher level in the years thereafter, and apparently a slight further increase in wages in 1929. Hourly earnings now seem to be less than 10 per cent below their 1920 level and for men and women run on the average between 55 and 60 cents, or more than twice as high as they were in 1914.

TABLE I

AVERAGE HOURLY EARNINGS IN MANUFACTURING INDUSTRIES

Year	National Industrial Conference Board	U. S. Bureau of Labor Statistics[a]
1920	$0.61	$0.62
1921	.52	...
1922	.49	.47
1923	.54	.54
1924	.56	...
1925	.56	...
1926	.56	...
1927	.57	.53
1928	.57	.54
1929	.58	.56

[a] Computed from series of average actual weekly earnings, published by the U. S. Bureau of Labor Statistics. See *Recent Economic Changes*, Chapter VI, p. 433.

It is well known that the advances of industry are irregular and that these irregularities are often concealed in the average. Thus wages in the cotton textile industry were in 1928 below their level of 1922; and wages in the boot and shoe industry less than 7 per cent higher in 1928 than in 1922. Hourly earnings in the men's clothing industry, while

TABLE II

AVERAGE HOURLY EARNINGS IN SELECTED INDUSTRIES

Industry	1913	1920	1921	1922	1923	1924	1925	1926	1927	1928
Boots and shoes	$0.31	$0.56	...	$0.50	...	$0.52	...	$0.53	...	$0.53
Clothing, men's	.26	...	...	.73	...	.76	...	.75	...	.73
Cotton goods	.16	.48	...	.33	...	.37	...	.33	...	.32
Hosiery and knit goods	.17	...	...	.35	...	.41	...	.44	...	.44
Iron and steel	.30	.75	...	.51	...	.64	...	.64	...	...
Lumber	.19	...	$0.33	...	$0.36	...	$0.36	...	...	.37
Woolen and worsted	.20	.63	...	.47	...	.53	...	.49	...	.51

Source: U. S. Bureau of Labor Statistics—"Special Bulletins" and *Monthly Labor Review*.

they are now no higher than they were in 1922, have nearly tripled since 1913 and show a greater increase over 1913 than any other industry.

TABLE III

AVERAGE HOURLY EARNINGS IN THE IRON AND STEEL INDUSTRY, 1913–1929 [a]

Year	All departments	Blast furnaces	Open Hearth furnaces	Sheet mills	Tin Plate mills	Bar mills
1913	$0.301	$0.205	$0.237	$0.483	$0.417	$0.288
1914	.301	.206	.237	.488	.425	.278
1915	.297	.207	.246	.450	.428	.266
1920	.745	.571	.671	1.039	.949	.713
1922	.513	.398	.480	.694	.650	.486
1924	.644	.520	.635	.809	.795	.585
1926	.637	.517	.677	.759	.704	.591
1929	.674	.528	.714	.793	.732	.625

Source: U. S. Bureau of Labor Statistics—*Monthly Labor Review*, September, October, November, 1929.

[a] In addition to the departments given in this table, Bessemer Converters, Puddling Mills, Blooming Mills, Plate Mills, and Standard Rail Mills are included in these figures. The five departments given separately were selected because they covered the largest numbers of wage earners. In 1929 the study covered 71,009 wage earners.

Hourly earnings in the iron and steel industry are in 1929 a little over 67 cents an hour and roughly 10 per cent below the average earnings of 75 cents an hour in 1920. The drop in wages of 23 cents from 1920 to 1922 has in the following seven years been reduced by 16 cents an hour.

TABLE IV

AVERAGE HOURS AND EARNINGS IN THE MOTOR VEHICLE INDUSTRY, 1922, 1925, 1928

Year	Number of wage earners	Average full-time hours per week	Average earnings per hour	Average full-time earnings per week
1922	56,309	50.1	$0.657	$32.92
1925	144,362	50.3	.723	36.37
1928	153,962	49.4	.750	37.05

Source: U. S. Bureau of Labor Statistics—*Bulletin No. 548, Monthly Labor Review*, May, 1929.

The automobile industry has, likewise, had the same quick and substantial recovery, so that the hourly earnings are in 1928 about 10 cents greater than they were in 1922. Automobile workers in 1928 were earning on the average of 75 cents an hour.

TABLE V

WEIGHTED UNION HOURLY RATES OF WAGES IN THE BUILDING TRADES[a]

Year	Rate	Year	Rate
1914	$0.53	1922	$0.96
1915	.53	1923	1.07
1916	.55	1924	1.15
1917	.58	1925	1.20
1918	.65	1926	1.28
1919	.75	1927	1.32
1920	1.02	1928	1.33
1921	1.03	1929	1.35

Source: U. S. Bureau of Labor Statistics—Special Bulletins, *Union Scale of Wages and Hours of Labor*.
[a] Rates as of May 1 for 1914 and 1915, and May 15 for each year since 1916. The actual rates from 1914 to 1920 are not published by the Bureau, but were computed from the Bureau's index numbers. These rates have been weighted by the number of members of the unions covered.

In the building trades there was no decline in hourly wages in 1921 but a drop of about 7 per cent in 1922. Thereafter, as is well known, wages began to climb and have continued to do so until they reached in 1929 a level about 30 per cent above 1920, or $1.35 an hour.

TABLE VI

HOURLY EARNINGS OF UNSKILLED OR COMMON LABOR, 1914–1928

Year	National Industrial Conference Board[a]	New York Federal Reserve Bank[b]	U. S. Bureau of Labor Statistics[c]
1914	$0.20[d]	$0.20	$0.34
1915	...	.20	.34
1916	...	.23	.35
1917	...	.27	.39
1918	...	.35	.46
1919	...	.43	.52
1920	.55	.51	.75
1921	.45	.47	.76
1922	.41	.37	.71
1923	.45	.46	.73
1924	.47	.48	.81
1925	.47	.47	.77
1926	.48	.49	.85
1927	.49	.49	.85
1928	.49	.49[e]	.86
1929	.50[f]	.50[g]	.86

[a] Arithmetic average of monthly data for each year. Covers unskilled male labor in manufacturing industries.
[b] Arithmetic average of quarterly data from 1914–1924, and of semi-annual data 1925 to date. Hourly rate of unskilled labor in New York Federal Reserve District.
[c] Average hourly union rate of wages for building laborers. Applies to May 1 for 1914 and 1915, and May 15 for each year since 1916. The actual rates from 1914 to 1920 are not published by the Bureau, but were computed from the Bureau's index numbers.
[d] July. [e] January 1, 1928.
[f] Preliminary figure. Covers nine months, January–September. [g] January 1, 1929.

The wages of unskilled labor dropped in both 1921 and 1922. But since 1922 the increase in the hourly earnings of unskilled labor has

been greater than in manufacturing industry generally. Unskilled labor, excluding the building trades where wages are considerably higher, appears now to earn 50 cents an hour, which is two and one-half times the level in 1914 and more than 25 per cent greater than in 1922.

Wages of all classes of steam railroad labor were, during this post-war decade, lowest in 1923, when they stood at about 58 cents an hour. They have been rising since, and during the first nine months of 1929 averaged 64 cents an hour.

The movement of wages in this country, following the break of 1920 and 1921, has, in this group of manufacturing, transportation, and construction industries, been steadily upward in the face of a substantial decline in the cost of living. As interesting as this fact is, the prevailing relation of hourly earnings of various industries is of even greater interest. Workers in the men's clothing industry, which is in many of its economic aspects not unlike the textile industry, earn nearly two and one-half times as much as the workers in the cotton textile industry and about 50 per cent more than labor in the woolen and worsted industry. Again, the labor force in the men's clothing industry is more than half female; that in the iron and steel industry almost exclusively male. Yet the average hourly earnings of all men's clothing workers is 6 cents greater than those of the steel workers. Comparison between wages in the rail transportation and automobile industries also shows curious results. The automobile industry is a new industry in which it is commonly assumed that skilled work has become unnecessary. In 1929 automobile workers were earning 75 cents an hour, or 11 cents more than the employees of the railroads. Obviously variations such as these, if they could be satisfactorily explained, would add materially to our conception of sound theories of wages.

So far as the total upward movement since 1922 is concerned, there is no question but that the availability of an adequate index of wage rates, in contrast with hourly earnings, would explain much that now remains in the dark. In the absence of such a series, it is only possible to venture the guess that, since 1922, there has been a wide divergence between rates of wages, piece and time, and hourly earnings; and that the divergence has been made possible by rising per capita output. If we were able to measure this divergence and observe its changes currently, we should have another powerful instrument for use in the processes of business forecasting, for we should then have a sensitive measure of the changes in industrial costs.

The course of wages in the soft coal industry since 1910 is a spec-

tacular illustration of the breakdown of two independent and disparate wage levels within what may be regarded as the same competitive area. Bituminous miners' wages reached their peak of 81 cents an hour in 1922 and have fallen to 62 cents in the first quarter of 1929.

TABLE VII

AVERAGE HOURLY EARNINGS OF MINERS AND LOADERS; INSIDE DAY MEN; AND OUTSIDE DAY MEN; IN BITUMINOUS MINES, 1919, 1922, 1924, 1926, 1929 [a]

	1919	1922	1924	1926	1929
Miners and loaders	$0.789	$0.845	$0.777	$0.749	$0.626
Inside day men	.585	.778	.725	.691	.623
Outside day men	.534	.694	.627	.594	.549
All occupations	.699	.811 [b]	.748 [c]	.719	.618

Sources: U. S. Bureau of Labor Statistics—*Bulletins 279 and 454*. *Monthly Labor Review*, September, 1929.

[a] The averages have been weighted by the number employed in each occupation. For miners and loaders, average hourly earnings based on "time in mine" were used. The 1929 study was made in the first quarter of the year.

[b] Includes data for 327 employees not included in the groups.

[c] Includes data for 636 employees not included in the groups.

Since the wages in the union fields were, on the whole, much higher than in the non-union, and the wage cutting in the union area designed to meet non-union competition, the decline in wages has been severer among the unionized workers. Thus pick miners in Illinois dropped from 85 cents an hour in 1924 to 66 cents in 1929, while the hourly earnings of pick miners in Pennsylvania were reduced from 71 to 59 cents, and in West Virginia from 76 to 61 cents. Machine cutters in West Virginia who were, in 1924, earning $1.06 an hour, were receiving in 1929, 98 cents; whereas the Illinois machine cutters were reduced in the same period from $1.38 to $1.05 an hour.

The standard hours of work are hard to measure. Many plants keep inadequate records on the matter. Some have no such thing as a standard week, or even day, but vary their hours with reference to industrial conditions from season to season and from year to year. It is also a matter of difficulty to discover in many cases whether punitive overtime rates are paid and, if not, how a short work-week differs from a long one. In large factories where customary practice is more widely known and less frequently violated, the records of the length of the standard week are sufficiently reliable; in small plants, this is not the case. Without assuming that the records tend to understate the length of the work-week, there is little evidence that the standard week has changed much in manufacturing industries since 1920. The large reduction in the hours of work came between 1914 and 1920, when the full-time week was reduced by 5 hours from 55 to 50 hours.

Since then the average has remained just below 50 hours a week. In the building trades, on the other hand, there is taking place a slow but steady reduction in the hours of work.

There is no concealing the fact that American statistics of trade union membership are becoming increasingly unreliable and that, in recent years, they have concealed the actual trend of membership. The total numbers enrolled in labor organizations have probably been decreasing, without interruption, in every year since 1920. Except for a few groups of unions, this decline has been general and, from present indications, is still under way. If this be the case, it raises theoretical questions of fundamental importance. Accepting some commonly held notions regarding the effects of trade unionism, it may have been the experience of this country since 1920 that the fear of trade unionism is as effective a stimulus to improved working conditions as the actual existence of labor organization. On the other hand, the phenomenon of a rate of wages of 75 cents an hour in the clothing industry and of 32 cents in the cotton textile industry, both highly competitive and mobile industries, puts an entirely different light on the relative effectiveness of a functioning trade union and the fear of impending organization. Again, much speculation has been trained on the conditions that may be regarded as favorable to the growth of trade unionism. The years since 1922 have been years of high production, rising wages, and probably of as great stringency in the labor market as in past periods of the same kind. Why, then, has the experience of American organized labor stood in such sharp contrast with its own past and with the history of foreign labor movements? These are questions that merit analysis, supported by the kind of quantitative data we now have available in this country; for the handling of much that will be crucial in the American industrial situation of the near future turns on a sound explanation of what has happened to American labor in this period since 1920.

RECENT CHANGES IN OUR WHOLESALE PRICE LEVEL

By Morris A. Copeland

Casual inspection of the fluctuations of the wholesale price level in the past eight years suggests that they may be due either to the ups and downs of general business conditions, or to changes in the credit situation as reflected in interest rates. Thus the Bureau of Labor Statistics Index rises in 1922–23, 1924–25 and 1928 and there are valleys in 1924 and 1927 and a dip late in 1929. The explanation of these movements in terms of interest rates, acting as a common cause upon individual prices, implies that quite different sorts of prices move somewhat similarly, although some prices may be affected sooner or more than others. According to the business conditions theory of the price level, also, diverse groups of prices may be expected to move somewhat similarly, either because general fluctuations in family income and demand affect most of them, or because they are by a network of competitive relationships articulated into a system of prices. Neither theory implies that all prices move together, but both involve a considerable homogeneity of price movements and more especially similarity of movements for averages of large groups of prices. Does such homogeneity in fact exist during the past eight years?

Some recent movements in the price level are difficult to account for either by interest rates or by general business conditions: the 1926 decline, the rise in 1927, and the sharp peak in September 1928. How shall we account for these movements?

A partial answer to both these questions is offered by a specially constructed three-group analysis of the Bureau of Labor Statistics Index [1] in which each finished product is classified in the same group with its chief raw materials. Certain commodities which compete closely in use are also classified together. The three groups are (1) domestic farm products and their manufactures, (2) mineral and forest products and their manufactures, (3) crude imports and their manufactures.

These three special group indexes show striking divergence of movement. In 1922 and 1923, the shape of the all-commodity curve results from the partly antagonistic, partly reinforcing movements of the two largest constituent groups. During the next three years, except for minor fluctuations in the winter of 1924–25, the all-commodity curve is practically a replica of the curve for the farm products group; the

[1] This analysis is described in the *Federal Reserve Bulletin*, December, 1929, pp. 772–5.

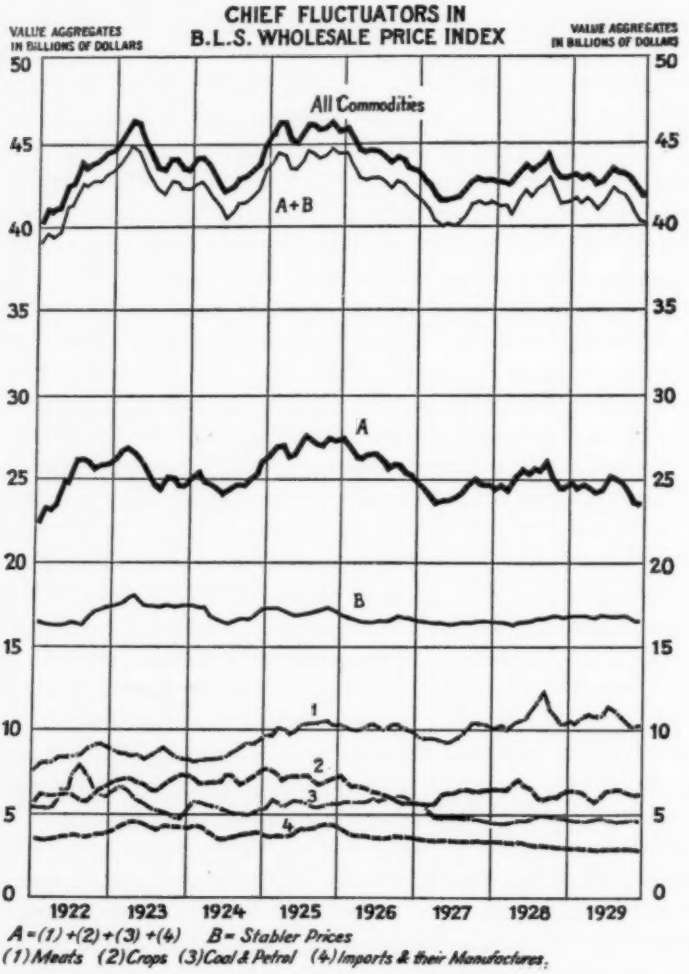
other two groups play little part in the fluctuations of the total index. In the winter of 1926–27, the decline in the wholesale price level appears to have been due mainly to a drop in the mineral and forest products group. Throughout the remainder of the period the all-commodity curve is again almost identical in shape with the curve for the farm group. Those movements of the all-commodity index which do not accord with either the interest rate or the general business conditions theory of the price level, the decline of prices in 1926, the rise in 1927, and the peculiar peak in September, 1928, are largely confined to the agricultural group. Is not an agricultural explanation of these movements fairly indicated? And if it is admitted that some movements of the wholesale price level are attributable to specific conditions in specific industries, where shall we draw the line? And which commodities are involved in any given movement of the general level?

A somewhat different grouping will help to localize the movements of the price level still further. In order to indicate as far as possible the movements which may with least question be attributed to other than special industry conditions, those commodities most remote from the influence of disorderly marketing and production policy and the vagaries of crop conditions have been classed together. Most of the other prices have been lumped in a second group as unstable. The Bureau of Labor Statistics Index is here treated as approximately a straight aggregative index. The light line in the chart immediately under the all-commodity index represents the sum of the aggregates of the stable and variable groups. The undistributed items (represented by the distance between the two top lines) are chiefly minor crops and foods. The light line traces quite faithfully the course of the all-commodity index. The lower part of the chart shows an analysis of the "unstable" group into four constituent subgroups;[1] (1) important animal products and their primary manufactures; (2) important crops and their primary manufactures; (3) bituminous coal, coke, and petroleum fuels; (4) crude imports and their manufactures.

While the curve for the "stable" group shows important undulations, they are sufficiently gentle so that there is a striking resemblance between the all-commodity curve and that of the variable group. In practically every minor movement and in most of the major movements, the all-commodity index reflects the gyrations of the variable group. The analysis of the variable group into four constituents ena-

[1] The sum of the four ordinates equals the ordinate of the variable group. The variable animal products group is made up of livestock, meats, lard, eggs, hides and leather, and wool textiles. The field crop group includes grains and flour, cotton and cotton textiles, hay, potatoes, tobacco, and linseed meal. Group (4) is the same as (3) in the preceding analysis. In the stable group there are (a) mineral and forest products and their manufactures, excepting bituminous coal, coke, and petroleum fuels, (b) dairy products, (c) apples and oranges, (d) lubricating oils, soap, starch, and manufactured tobacco.

bles us to trace movements of the all-commodity index to individual commodities. The sharp rise to a minor peak in the summer of 1922 is due to the bituminous coal strike—this rise would have been sharper still but for a dip in dairy products. To the March, 1923, peak and subsequent decline building materials, sugar, cotton, and petroleum



contributed largely. The two minor peaks in 1923–1924 are due to meats and petroleum respectively. The sharp rise beginning in the summer of 1924 is chiefly the upward phase of the hog cycle. This was reinforced early in 1925 by a slight general rise in the stable group and by rises in petroleum, wheat and corn, due chiefly to small crops

and the decreased number of the wells sunk in 1924. In the latter part of 1925 the rubber restriction plan contributed to the high level of prices. While the stable group slopes gently downward in 1926–27, the bulk of the drop in the all-commodity index in 1926 is traceable to bumper cotton and wheat crops and the failure of rubber restriction. In the winter of 1926–27 the decline was chiefly the downward phase of the hog cycle and of the cycle in petroleum prices and number of wells sunk. A declining cattle population, a 30 per cent drop in the cotton crop, and a favorable demand for feeder corn brought price increases in 1927 that sent the all-commodity index sharply upward in the middle of the year. Further increases in crop prices are reflected in a minor peak in May, 1928, while the sharp September, 1928, peak represents the disorderly marketing of livestock. Opposing movements in crops and meats during the following winter and spring largely neutralized each other. The summer dip and rise in the all-commodity index in 1929 was primarily due to grains. The sharp decline in the wholesale price level in the last quarter is traceable chiefly to hogs and pork.

With a gradually declining number of livestock there has been a marked upward trend in the meat group throughout the period. Without this group the total index would show a definite downward trend. Improved technology and discovery have brought maladjustment of output and demand in crops, in petroleum, and combined with doubtful valorization schemes in import commodities. Lumber, coal, hides, and certain textiles have faced a cut in demand due to competing commodities. Manufacturing costs and demand for materials have been cut by improved processes. Some industries have had to work off a war-time heritage of surplus stocks and excess capacity. Even in the "stable" group the influence of specific factors on specific commodities is present. And yet some of the movement in this group presumably reflects general changes in consumers' income and demand—and a similar influence may be obscured by other factors in the movements of other commodities. But the bulk of the movements of the wholesale price level since 1924 appears to be traceable to specific identifiable conditions affecting the supply and demand of specific commodities and affecting supply much more often than demand.

During the war period it may well have been true that prices were by a network of competitive relationships articulated into a system so that all tended to move together. Something like this is discernible, apart from coal, in the early years of the present period. But since 1924 it would perhaps be better to speak of a number of loosely related

systems of prices, than of a single system. The parts of the price structure are less closely articulated in some periods than in others, and some parts perhaps are less closely articulated for short-time movements than for longer trends, or conversely.

The domination of the movements of the all-commodity index by a few basic commodities suggests the question, May not the present index over-state the fluctuations of the wholesale price level? It is easier to collect information on basic commodities than on highly elaborated articles, partly because the latter are more numerous, and partly because changes of style and model are more frequently a complicating factor. Existing information on elaborated articles and branded goods is relatively far less complete than that on basic commodities.[1] Had it been possible to include a fuller representation of the more highly elaborated and branded articles with their stabler prices it seems likely that the all-commodity index would have fluctuated within narrower limits.

Marshall tells us that for purposes of static price theory supply and demand are like a pair of scissors—neither cuts alone. But for dynamic purposes *changes* in supply may be far more important than *changes* in demand in bringing about *changes* in prices. This seems to have been true of important basic commodities in recent years. For static theory, too, overhead costs so complicate the situation that it is not possible to formulate any tenable statement of a precise relation between cost and price. But it may still be true dynamically that *changes* in direct materials costs are frequently reflected in *changes* in price. In tracing the fluctuations of the wholesale price level chiefly to changes in conditions of supply in basic industries we assumed that these changes would affect not only the prices of the raw materials, but also the prices of their products. But the raw-material finished-product relation might be obscured by other factors. Do we in fact find our total groups reflecting changes in the prices of their raw materials?

A comparison of the three group indexes, (1) farm products and their manufactures, (2) mineral and forest products and their manufactures, and (3) crude imports and their manufactures with corresponding indexes of the chief crude materials in each of these groups, shows fairly close agreement in timing, direction and amplitude of movement in each case.[2] This correlation between the three raw-material and their

[1] On the basis of "value added" the distribution of weights as between (1) farm products, (2) mineral and forest products, (3) crude imports and (4) manufactures seems entirely reasonable. But within the manufactures group the omission of many highly elaborated articles puts an undue emphasis on semi-manufactures. The following industries contribute 45 per cent of all the weight assigned to manufactures in 1926: meat packing, sugar refining, grain milling, petroleum refining, coke and gas manufacture, metal smelting and refining and rolling mills, planing and saw mills, and leather. They constitute only 28½ per cent of the value of manufactures in 1925 and only 20 per cent of value added.

[2] See *Federal Reserve Bulletin*, December, 1929, pp. 774–5.

respective total group indexes is chiefly a correlation for certain heavily weighted basic commodity relationships—livestock and meats; coal and coke; petroleum and its products; wheat and flour; raw and refined sugar; rubber and tires; cotton and wool and their textiles; etc. But these are precisely the commodities whose price fluctuations are of outstanding importance for an understanding of the fluctuations of the all-commodity index.

On the whole our findings appear consistent with the view that changes in supply conditions in specific industries have been the chief source of changes in prices of raw materials and that changes in specific raw materials costs have been the predominant influence in price movements of products. It would not be easy to reconcile these findings with a theory of the price level that attributes chief importance to changes in general demand conditions such as fluctuations in the national income or the volume of credit.[1]

By way of conclusion, we may offer tentatively two propositions and a corollary: (1) The wholesale price level since 1924 has moved chiefly in response to changes in supply conditions and the prices of raw materials. (2) The price movements largely responsible for changes in the wholesale level are in industries where the output of raw materials is not closely or quickly adjusted to demand—bituminous coal, petroleum, and domestic agriculture; also certain crude imports. Corollary: If the wholesale price level moves chiefly in response to supply conditions in extractive industries the road to stabilizing it is not, at least for the most part, a quick and easy one via credit mechanisms; *under present conditions* it is the far more arduous one of stabilizing cotton, wheat, and corn farming, hog production and marketing, and the bituminous coal and petroleum industries. So long as these industries remain unstabilized it will be difficult to avoid those fluctuations in the wholesale price level which have dominated its movements in recent years.

[1] It should be noted that the influence of credit upon the price level is not necessarily conceived as the influence of interest rates—a common cause acting upon a large group of prices and giving rise to a considerable homogeneity of price movements. To say that credit conditions affect the wholesale price level may mean also that $MV+M'V'$ is the active factor in the equation of exchange. This formulation does not require homogeneity of individual price movements. It assumes merely that the *total* PT—or $PT+R$—is controlled by $MV+M'V'$. This question was examined in the *Quarterly Journal of Economics*, August, 1929, pp. 648–66. It may be recalled briefly (1) that wholesale trade represents probably about 1/10 of all $PT+R$, and so the control of the total $PT+R$ does not necessarily closely influence this fraction, which in the period under review has moved quite differently from other $PT+R$ items, and (2) that present information is apparently more nearly consonant with the view that $PT+R$ is the active factor in the equation of exchange most of the time, than with the view that $MV+M'V'$ is the active factor.

EUROPE TEN YEARS AFTER THE WAR

By Marcus Nadler

The economic and political changes brought about by the War were so drastic that Europe in 1919 was confronted not merely with the problem of reconstruction, but with the problem of reorganization on an entirely new basis. Not only did the political geography of central Europe change beyond recognition, but economically Europe emerged from the War completely altered. A large percentage of the manpower was dead or crippled, savings of the middle class to a large extent were wiped out, economic units were disrupted, labor was dissatisfied and inefficient and the specter of a social revolution was everywhere prevalent. The foundation of the new order was therefore one of the most difficult tasks with which Europe has been confronted since the end of the Thirty-Year War.

It is obvious that economic developments in Europe during the past ten years cannot be appraised in an article of this size. This review, therefore, by necessity is limited to a brief description of the progress made, with a short analysis of the cost at which this progress has been attained and a brief survey of some of the outstanding problems with which Europe is confronted.

Even the most pessimistic observer must admit that economic conditions in Europe have improved considerably during the decade following the signing of the Treaty of Peace. The fluctuation and depreciation of the currencies which made sound economic planning for the future almost impossible, which prevented the necessary accumulation of capital in the individual countries and which brought about a holocaust of speculation, are a thing of the past. With the exception of Spain and Portugal, the currencies of all European countries have been stabilized, on what appears to be a relatively permanent basis. The accumulation of capital is increasing, and rationalization and conscious planning in industry and trade have taken the place of reckless speculation and exchange dumping. The finances of the various governments which after the War were balanced with the aid of treasury certificates and of the printing presses of the central banks, thereby causing currency inflation and exchange depreciation, have been reorganized and in most countries placed on a sound basis. The dissociation of the state finances from the banks of issue is one of the most noteworthy developments in post-war Europe.

Production and trade, domestic as well as foreign, have continually

increased and at the present time exceed the pre-war level in most countries of Europe. The increase in economic activity coupled with the introduction of modern methods of production, aided by the inflow of capital from the United States and by the gradual abandonment of trade restrictions, has brought about an increase in the purchasing power of the masses and a substantial rise in their standard of living. The resources of the banking institutions, commercial, savings and agricultural, which have been greatly depleted on account of the depreciation of the exchange, have been replenished and with few exceptions have surpassed the total of 1913. The gold reserves of the central banks of Europe have continued to increase and in most countries of Europe are not only sufficient to meet the present needs of currency and credit but to take care of future expansion.

The problems of interallied debts and particularly of reparations which for years were the most disturbing elements in the economic development of Europe, have been taken out of the quagmire of politics and an attempt made to place them on an economic basis, and to find for them an economic solution. The trade relationships of the various countries of the world disrupted and shattered by the breaking up of century-old economic units, by unequal provisions of the peace treaties, by nationalistic rivalries and aspirations, have been slowly but gradually restored. Import and export restrictions with the exception of those in Russia have been generally abolished, commercial treaties concluded and serious efforts made by individual countries to adapt themselves to the new conditions created by the Treaties of Peace.

From the above survey it would appear, therefore, as if the recovery of Europe has been real and that present-day Europe in the matter of production, consumption and credit facilities is ahead of the pre-war level. This conclusion is generally reached by those who base their analysis on a statistical or quantitative study. Any study based on quantitative measurements alone, however, is misleading, for it shows merely the results without indicating the causes which brought about this improvement or the factors at work which would indicate the trend of the future.

It is, therefore, proposed to analyze briefly some of the achievements of the European nations and to ascertain how permanent they are, at what cost they were attained, and what dangers they hold for the future economic development of Europe.

The Young Plan fixed the total number and amount of annuities to be paid by Germany on account of Reparations, while the Bank for International Settlements is intended to take the last vestige of political interference from the reparations problem. On the surface, therefore,

it would appear that the question of reparations is a closed chapter and will cease to be a disturbing factor in the future economic development of Europe.

A careful analysis of the Young Plan, however, reveals that the matter of reparations is still very far from being a closed incident in the post-war economic history of Europe. The annuities, although divided into conditional and unconditional parts, thereby affording the German currency some protection, were not based on Germany's capacity to pay. This does not imply that the experts who drafted the Young Plan did not make a searching study of the economic and financial conditions of Germany. What is implied is that the five years during which the Dawes Plan was in operation and the recovery made by Germany during these years form no index of Germany's progress or capacity to pay. Capital obtained abroad during these years was not only sufficient to meet the reparation payments in cash but to cover a considerable part of Germany's imports. Furthermore, the inflow of several billion marks from abroad artificially stimulated German production and trade. Hence Germany's ability to pay reparations during 1924–1929 as well as Germany's rapid economic recovery were to a very large extent based on foreign loans. If Germany in the future is unable to obtain foreign loans on a large scale she will either be unable to meet her reparation obligations in full or she will be bound to force her exports on such a scale as may constitute a serious menace to the other exporting nations of Europe.

The plan envisaged by the experts who drafted the Young Plan that the Bank for International Settlements will be an important factor in the development of the natural resources and of the foreign trade of the world, must be considered at least as postponed, for the powers of the bank as revealed in the recently published statutes have been so curtailed that it is doubtful whether this much-heralded situation will be able to do more than carry out the functions hitherto performed by the Agent General for Reparations. The removal of the reparations problem from a political to an economic basis by transferring the functions of the Agent General for Reparations to the Bank for International Settlements is also more apparent than real, for the directors of the Bank will be the governors of the central banks who, as was seen at the Paris and Baden Baden Conferences, reflect not only their own views but those of their governments.

One may therefore conclude that the reparations question in the year 1930 is just as much an unsolved problem as it was in 1924 when the Dawes Plan was written and the first attempt was made to place the reparations problem on an economic basis.

Perhaps the most striking phase in European recovery is the rapid increase in production. In analyzing this phase of post-war European economic development, one must consider only industrial production, for agriculture is often beyond the control of the producer and depends to a considerable extent upon climatic conditions.

Not only has the output increased, but the productivity of the individual laborer has risen. The increase in production may be ascribed primarily to the rationalization of industry, the introduction of labor-saving devices, the merging of industrial establishments, the elimination of unproductive plants and in general to the adoption of American methods of mass production. In this respect, Europe was chiefly guided by the results obtained in the United States. In adopting American methods of production, the European captains of industries overlooked the fundamental principle that while American production is based on domestic consumption and on the purchasing power of about 120,000,000 persons with a comparatively high standard of living, Europe's production, and particularly that of the industrialized countries of Western Europe, is to a large extent based on exports with the purchasing power of the masses much smaller than that of the United States.

The adoption of American methods of production has led to unemployment in many countries in Europe on a scale unknown in pre-war Europe. Unemployment is a serious problem not only in Germany and England, where the total number of unemployed is over one million, but also in Austria, Poland, Italy and Hungary. The large number of unemployed in some of the European countries in turn represents not only an economic waste but also imposes a heavy burden on the state which is forced to pay unemployment doles. So far no solution has been found to remedy the unemployment problem and no solution is in sight for the future. Thus the increase in production and in efficiency of labor was achieved only through the unemployment of hundreds of thousands of workers and by decreasing their purchasing power and standard of living.

The balancing of the budgets of most European countries which is one of the fundamental prerequisites of a stable currency is, upon careful analysis, also more apparent than real. Budgets have been balanced but not so much by decreasing expenditures as by increasing revenues, which, however, not only is a great handicap to future business expansion but presses hard on the standard of living of the masses. The published military expenditures in most countries still constitute the largest item on the expenditure side of the budget. Yet, large as they are, they do not by any means include the total amounts spent for national defense.

The heavy burden of military expenditures reflects the great political uneasiness and uncertainty prevailing in Europe and, one may safely say, the injustices of the treaties of peace. While today there seems to be a real desire for peace, the political leaders in old Europe still cling to the old slogan *Si vis pacem para bellum*, and this preparation for war is sapping the life blood of the new political units.

Europe has gone through one of the most critical stages in modern history. Century-old empires were crushed and split up. New political units were established without economic or racial considerations. Balkanized, impoverished, split between victors greedy to hold on to what the generous peacemakers accorded them and the vanquished resentful with heavy reparation burdens, Europe faced the difficult task of reconstruction. Upon the success of reconstruction depended the question of whether large parts of Europe would retain the capitalistic form of government or embrace the new gospel preached by Lenin. Progress has been made but the struggle is still on, and in this struggle Europe is undergoing a change far more significant than the geographical changes made at Versailles. Cartels and trusts, international in scope, are being constantly created which reach far beyond the national boundaries. The organization of the individual industries in the industrialized countries is progressing rapidly, assuming in many instances the form of a huge trust. The laboring masses on the other hand are becoming more and more class-conscious and are endeavoring not only to strengthen their trade unions but also to gain control over the political machinery. Economically, the face of Europe is changing rapidly and is assuming an entirely different aspect from that of prewar days. What the outcome of these developments will be, only the future can tell.

DISCUSSION

By Robert B. Warren

The preceding papers have been so varied in their subjects and so detailed in their contents, that in the limited time at our disposal, rather than discuss them in detail, I shall do no more than consider their common theme—the past decade, and some of its outstanding contrasts between Europe and America. From one point of view, each of these papers emphasized a phase of the hazard of economic life—the risk of enterprise. In the past few hundred years, the community has learned how to eliminate many of the hazards which formerly threatened it. The community no longer fears famine, or plague for example. But at

the same time that society has been erecting defenses against these, it has been changing its economic structure in such a way as to introduce new hazards into the life of the individual. Important among these, as Dr. Nadler emphasized, is unemployment, which exposes the individual to famine and, often complicated by illness, reproduces in the individual a hazard from which society has freed itself and from which the individual was formerly freer. As our economic life has become more complicated, an ever larger proportion of the population joins what for want of a better name may be called the proletariat; that is, it obtains its livelihood precariously, each working not for himself but for an employer over whose success or failure he has no control. Contemporary economic life seems to be peculiarly subject to fluctuation in demand, and while some progress has been made in recent years in reducing this, generally the best a given corporation can do is not to eliminate the hazard, but to shift its incidence. And it seems that in many cases this particular hazard of industry is simply passed on to the workers. So erratic has been the course of industry in recent years in industrialized Europe that one can say that half of the industrial population of the continent suffers continuously from the nightmare of unemployment. Individually they live only a few days removed from potential destitution.

Labor in Europe has been neither able nor willing to shoulder this hazard. From its economic weakness it has taken refuge in its political strength, and insisted in turn on passing the incidence of the hazard back upon society (or industry) by demands for unemployment doles, sick benefits, old age pensions and what not. In effect one can say that the owners of industry, the shareholders, first succeeded in passing a major hazard of industry on to the workers, and the workers, through political measures, have in Europe largely transferred it back to the owners. This has been a major fact in European socio-economic life of the past decade.

Our life has been free from it for two reasons:

1. Our periods of unemployment have been brief.

2. The continuous release of labor, from improving technique both in agriculture and industry, has been matched by a continuous expansion of industry, so that the worker released by an innovation, has always presently found another and usually a better job in some other field.

We have been free in this country, therefore, from a kind of political-economic agitation which has been characteristic of Europe over the past decade. We have had at the same time a variant—our agriculturists, distressed by a hazard peculiar to their industry, have sought a remedy in politics, and so we have had continuous and usually vague

appeals for "farm relief"—a manifestation of the same effort to shift an economic hazard from one group to the community.

Now, unemployment, from which we have been so free over the past decade, seems to be one of the inherent risks of an industrialized society. Sooner or later, it is not unlikely that we shall find our economic life paralleling more closely that of Europe; the happy freedom not only from unemployment, but from an unemployment "problem," which has been peculiar to us among industrial nations, may pass, and we may find ourselves confronted with it. This may indeed develop within the coming decade; and if and when it does, its victims will take refuge in political action, like their industrial counterparts in Europe and their agricultural counterparts here. Indeed, if one wished to assume one of the risks of the statistical profession and, on the basis of the past decade venture a guess about the coming decade, he might suggest that in this country over the next ten years industrial relief, whether old age pensions, unemployment insurance or what not, may replace farm relief as a major topic of political-economic discussion.

MINUTES OF THE ANNUAL BUSINESS MEETING

The first session of the Annual Business Meeting of the American Statistical Association was held in the Rose Room of the Hotel Washington on Saturday, December 28, 1929. President Edwin B. Wilson presided during the early part of the meeting, and Vice-President Mordecai Ezekiel during the latter part of the meeting.

The report of the Joint Advisory Committee to the Director of the Census, signed by Dr. Walter F. Willcox, was read by the Secretary. A motion to adopt the report as read was carried.

Dr. Edmund E. Day as Chairman reported, on behalf of the Committee on Honorary Members (consisting of E. B. Wilson, E. Dana Durand, Robert E. Chaddock, Walter W. Stewart and himself), the following names for that grade of membership:

Ladislaus von Bortkiewics, Professor of Statistics and Political Science, University of Berlin

A. W. Flux, Head of the Statistics Department, Board of Trade, London, and President of the Royal Statistical Society

Gustav Thirring, Professor of Statistics, University of Budapest; Hungarian Academy of Sciences

Eugene Wurzburger, Professor of Statistics, University of Leipzig

A motion to adopt the report of the Committee was carried.

The report of the Committee on Institutional Statistics was made by Dr. Horatio M. Pollock. This report was also adopted as read.

Professor Harry C. Carver presented the report of the Committee on *The Annals of Mathematical Statistics*. A motion was carried to adopt this report.

Dr. Louis I. Dublin, Chairman of the Committee on Fellows, reported that the Committee had elected no new Fellows this year. This report was read by the Secretary, and adopted.

The Secretary-Treasurer also reported that the Committee on Finance had given material aid during the year as regards the investment of the funds of the Association and that these investments had thus far proved sound, there being, at the present time, no noticeable depreciation of the price of the securities purchased.

Colonel Leonard P. Ayres, as Chairman, reported on behalf of the Nominating Committee the following nominations:

President: Malcolm C. Rorty

Vice-Presidents:

1. Collection and classification of data and administration of statistical agencies,
   Donald R. Belcher
2. Statistical and actuarial methods and technique, and the teaching of statistics,
   Arthur R. Crathorne

3. Facts and methods pertaining to political science, sociology, social welfare, labor problems and vital statistics,
   R. H. Coats
4. Facts and methods related to anthropology, biometry, psychology, and education,
   Edward L. Thorndike
5. Facts and methods bearing upon economics and economic theory,
   W. Randolph Burgess
6. Facts and methods pertaining primarily to business,
   Bradford B. Smith

Secretary: Willford I. King
Treasurer: Willford I. King
Editor: Frank A. Ross

A motion was made to close the nominations and to instruct the Secretary to cast the unanimous ballot of the Association for the nominees listed. This motion was unanimously adopted.

The meeting adjourned.

The second session of the Annual Business Meeting of the American Statistical Association was called to order by President Edwin B. Wilson on Monday, December 30, in the Rose Room of the Hotel Washington, Washington, D. C.

Miss Mary van Kleeck reported that the Encyclopaedia of the Social Sciences was now publishing its first volume. She recommended that the complete Encyclopaedia be presented to Dr. R. H. Coats, the other member of the Committee, stating that she already had a set. A motion was made and carried to recommend to the Board of Directors that this presentation be made. The report of the Committee on the Encyclopaedia of the Social Sciences was accepted.

Miss van Kleeck also made the report for the Committee on Governmental Labor Statistics. This report was likewise adopted.

The report for the Committee on Social Statistics was made by its Chairman, Dr. Stuart A. Rice. This report was accepted.

The report of the Secretary was read by Willford I. King, the present incumbent. A motion was carried to approve this report.

The report of the Treasurer was also read by Willford I. King, Secretary-Treasurer. This report, including the letter of approval by the Auditors, was accepted.

The following resolution, offered by Dr. Louis I. Dublin, was adopted by the Association:

> WHEREAS, the Social Science Research Council has, after much study, outlined a project for increasing our knowledge of the consumption habits of the American people, and
>
> WHEREAS, this project can be best realized under Federal auspices and with Governmental support, and
>
> WHEREAS, this project, when completed, will serve the agencies of Government, of business, and of social welfare in general

BE IT RESOLVED, that the American Statistical Association records itself as in favor of the study as planned by the Social Science Research Council,

THAT, it urges that this study be undertaken as soon as possible,

THAT, this resolution be transmitted to the President of the United States with the request that he approve the proposed investigation as a project of the Federal Government and refer it to the appropriate department for early execution, and

THAT, the American Statistical Association will give its full support and coöperation to that department of the Government which is entrusted with the execution of this project.

The following resolution was offered and unanimously adopted:

RESOLVED, that the American Statistical Association extend to General Wendell C. Neville its hearty thanks for his courtesy in delegating a section of the Marine Band to play at the Annual Meeting of the American Statistical Association at the Hotel Washington.

A motion was unanimously carried by a rising vote to extend the thanks of the Association to President Edwin B. Wilson, and the committee which assisted him, for the preparation of a most excellent program—a program which was found, not only interesting, but enlightening, by the great majority of members in attendance.

A motion was also unanimously adopted by a rising vote, expressing the appreciation of the members of the Association for the very effective arrangements for the meeting made by the District Secretary, Mr. Thomas B. Rhodes, and for the coöperation, in these arrangements, of the management of the Hotel Washington.

A motion was made and carried instructing President Edwin B. Wilson to appoint a committee to report on the relationship which should be maintained between the American Statistical Association and the American Association for the Advancement of Science. The motion further instructed the Board of Directors to discuss with the officials of the American Economic Association and the American Sociological Society, the question of whether or not these Associations, in conjunction with the American Statistical Association, should next year hold their Annual Meetings in conjunction with the American Association for the Advancement of Science.

The meeting adjourned.

WILLFORD I. KING, *Secretary*

REPORTS

Report of the Secretary

Membership, December 1, 1928		1,904
Additions during 1929	337	
Deductions during 1929:		
Deaths	7	
Resignations	75	
Dropped because unable to locate	2	
Dropped for non-payment of dues	91	
	175	
Net gain in membership during 1929		162
Membership, December 1, 1929		2,066
Besides members we have:		
Subscribers, mostly libraries	530	
Domestic exchanges	21	
Foreign exchanges	23	
		574
Total members, subscribers, and exchanges		2,640

The following deaths were reported during the year:

Mr. John Balch Blood	Dr. Jeremiah W. Jenks
Dr. William H. Davis	Dr. William S. Rossiter
Mr. John P. G. Dowman	Dr. Julius de Vargha

Professor Allyn A. Young

Four numbers of the JOURNAL, containing 456 pages, together with the Supplement, containing 275 pages, have been issued in 1929. This composes Volume XXIV.

There were 24 pages of paid advertising in the four issues.

One of the outstanding events of the year is the appearance of the first number of *The Annals of Mathematical Statistics*, of which Professor Harry C. Carver is Editor and J. W. Edwards is Business Manager.

Mr. D. C. Elliott, of the Midland Bank, has succeeded Mr. Harmen B. Flinkers as Secretary of the Cleveland Chapter. Mr. Flinkers is now president of that organization.

Mr. Lester K. Kirk, of the Standard Accident Insurance Company, is now District Secretary for the Detroit region, taking the place of Mr. A. Heath Onthank, who has left Detroit.

Mr. George A. Doyle, of the Bell Telephone Company, has succeeded Dr. John H. Cover, now of the University of Chicago, as District Secretary for Pittsburgh and vicinity.

Mr. Thomas B. Rhodes, of the Federal Reserve Board, is now District Secretary for Washington and environs, taking the place of Dr. Woodlief Thomas, who is in Europe.

We have reports of meetings held by district organizations as follows:

Chapter	*Number of Meetings*	*Average Attendance*
Austin	4	25
Boston	2	118
Chicago	8	51
Cleveland	10	26
Columbus	5	48
Detroit	3	30
Los Angeles	8	15
New York	6	246
Pittsburgh	4	25
San Francisco	4	42
Washington	1	50

WILLFORD I. KING, *Secretary*

Report of the Treasurer, Covering the Period December 1, 1928, to December 1, 1929

Cash on hand December 1, 1928	$6,620.02	
Gross cash receipts during year	20,504.43	
		$27,124.45
Gross cash disbursements during year		25,636.62
Cash on hand November 30, 1929		$1,487.83
Gross cash receipts during year	$20,504.43	
Refunds	348.44	
Net cash receipts during year		$20,155.99
Cash payments during year	$19,453.64	
Purchase of Bonds	6,182.98	
Gross cash disbursements during year	$25,636.62	
Refunds	348.44	
Net cash disbursements during year		$25,288.18
Cash in Checking Account, Bank of America, November 30, 1928	$21.05	
Cash on hand, not deposited, November 30, 1928	6.48	
Cash in East River Savings Bank, November 30, 1928	6,567.15	
Cash in Emigrant Industrial Savings Bank, November 30, 1928	25.34	
Total		$6,620.02

Net Cash Receipts

Individual membership dues	$9,788.90	
Corporate membership dues	900.00	
Subscriptions to JOURNAL	2,955.70	
JOURNAL sales	1,059.91	
Memorial Volume sales	184.74	
Advertising in JOURNAL	621.00	
Interest on savings	375.14	
Dividends	148.75	
New York meetings	3,288.05	
Sale of miscellaneous books to members	411.15	
Payments by authors for reprints	422.65	
Total receipts		20,155.99
Total		$26,776.01

Net Cash Disbursements

Cost of JOURNAL:		
December, 1928, edition, including reprints	$1,204.64	
Handbook	591.09	
March, 1929, edition, including reprints	1,136.42	
PROCEEDINGS, including reprints	2,202.62	
June, 1929, edition, including reprints	1,114.44	
September, 1929, edition, including reprints	1,137.75	
New York meetings	2,260.33	
Postage, stationery, and miscellaneous printing	1,090.57	
Salaries	6,449.62	
Rent	328.00	
Telephone and telegraph charges	79.18	
Annual Meeting	512.99	
JOURNALS bought back	325.50	
Shipping JOURNALS	30.00	
Furniture	24.00	
Bonds—market value 11/30/29 plus accrued interest	6,163.32	
Miscellaneous books sold to members	410.91	
Miscellaneous expenses, Secretary's office	45.87	
Miscellaneous expenses, Editor's office	180.93	
Total disbursements		$25,288.18
Cash in Checking Account, Bank of America, November 30, 1929	$110.99	
Checks deposited for collection in Bank of America, November 30, 1929	12.00	
Cash on hand, not deposited, November 30, 1929	10.83	
Cash in Emigrant Industrial Savings Bank, November 30, 1929	1,354.01	1,487.83
Total		$26,776.01

Reconciliation Statement

Cash on hand December 1, 1928		$6,620.02
Gross cash receipts during year	$20,504.43	
Refunds	348.44	
Net cash receipts		20,155.99
Cash at beginning of year plus net cash receipts		$26,776.01
Gross cash disbursements	$25,636.62	
Refunds	348.44	
Net cash disbursements		25,288.18
Cash on hand November 30, 1929		$1,487.83

Functional Apportionment of Expenditures
(Including Overhead)

Annual meetings and New York meetings	$4,082.55	
JOURNAL, Proceedings, and Handbook	11,420.95	
Employment Clearing House	906.97	
New members	784.59	
Miscellaneous	2,133.28	
Total expenses		$19,328.34
Miscellaneous refunds	$125.30	
Purchase of bonds	6,182.98	6,308.28
Total cash disbursements		$25,636.62

On December 1, 1929, the Association possessed, in addition to stationery and miscellaneous supplies, the following assets:

17 shares of Boston and Albany stock, market value, December 1	$2,975.00
Furniture carried at	461.61
Accounts receivable (unpaid advertising)	43.00
JOURNALS, 8,664 copies.	
Memorial Volume, 52 copies.	
Bowley-Edgeworth pamphlets, 38 copies.	
Bonds—market value 12/1/29 plus accrued interest	6,163.32

There were no bills outstanding.

WILLFORD I. KING, *Treasurer*

Report of the Auditing Committee

We have examined the books and records in the office of the Treasurer of the American Statistical Association and have verified the bank balances.

We hereby certify that the Treasurer's report submitted is in accordance with the books and records, and in our opinion correctly represents the financial condition of the American Statistical Association as of November 30, 1929, and receipts and disbursements during the year December 1, 1928, to November 30, 1929.

ROBERT W. BURGESS
F. LESLIE HAYFORD
Auditing Committee

NEW YORK, N. Y.
December 23, 1929

Report of the Editor

During the past year no material alterations have been made in the JOURNAL except the discontinuance of the Recent Literature section. This discontinuance has been due to the appearance of *Social Science Abstracts* under the auspices of the Social Science Research Council.

The annual meetings were very extensive last year and in consequence the PROCEEDINGS volume was abnormally large. As a result of the high cost of the PROCEEDINGS the size of subsequent issues has had to be somewhat reduced, though the total number of pages for the year was decidedly larger than heretofore.

Sizes of the several issues including the Proceedings were as follows:

March	108
PROCEEDINGS	275
June	124
September	116
December	108
Total	731 (regular issues, 456)

This compares with 678 total pages in 1928 and with 550 in 1927, the two years during which the PROCEEDINGS have been issued.

The coming year will mark the appearance of *The Annals of Mathematical Statistics* as a second publication of the American Statistical Association under the editorship of Professor Harry C. Carver. It has long been an impossible task for one journal to be the organ of the entire statistical fraternity of the country. Coöperation between the editors of the two journals will make these publications of the Association progressively useful to the fraternity.

The Editor wishes to express on behalf of the Editorial Board thanks not only to the contributors of manuscripts and of reviews but also to the District Secretaries and others for their aid in making the Miscellaneous Notes section worth while, and to reiterate thanks to Dr. Wolman for his splendid work in the Reviews section.

FRANK ALEXANDER ROSS, *Editor*

Report of the Committee on Governmental Labor Statistics

The principal tasks of the Committee during the year consisted in the completion of a report, begun in the summer of 1928, on employment indexes in the United States and Canada, the promotion of an index of the numbers and earnings of the employees of the New York City government and the development of recommendations for a census of unemployment as part of the federal census of 1930.

At its annual meeting in 1928 the American Statistical Association passed the following resolution:

> *Resolved*, that the American Statistical Association authorizes its Committee on Governmental Labor Statistics to confer with the Director of the Census regarding the following urgent needs in statistics of employment and earnings in the United States: (1) The continuance of the publication of monthly statements of employment in the census of manufactures. (2) The addition to the schedule of an inquiry for and the publication of data on total wages corresponding to the data on earnings now collected for a sample number of establishments by the Bureau of Labor Statistics. (3) The inclusion of inquiries for statistics of monthly employment and earnings in the schedule for the census of distribution.

In regard to the publication of monthly statistics of employment in the census of manufactures, the Committee finds that, because of the bulk of the work on the coming decennial census, the Bureau of the Census has departed for 1927 from its practice of publishing monthly employment figures for all individual industries and instead has limited the tabulation to 13 industries (one more than previously announced). These data have already become available.

In the census of manufactures for 1929 and 1931 the inquiry in regard to the number of wage-earners employed on the fifteenth of each month or nearest representative day will be retained on the schedule and if practicable the monthly employment figures will be tabulated for all industries. In any event, after the close of the fifteenth census period the publication of the monthly employment figures will be resumed.

In regard to the collection of statistics of monthly wages the Director of the Census has advised the Committee that the "amount of work already planned, in line with recommendations of the Advisory Committee, appointed by the Secretary of Commerce, is so great as to render it impracticable to undertake anything further, and especially anything of an experimental character."

In the census of distribution it has been found impracticable to ask for complete *monthly* data on employment in every case; but employment on the fifteenth day of quarterly months, by sex, will be given for practically every industry; for the construction industry the data will be given by months. The securing of payroll statistics as well as numbers of employees is being considered, as well as setting off part-time employees from full-time in the retail trades, where, it is believed, the part-time employment situation is most important.

(1) *Employment Indexes in the United States and Canada*

A survey of the index numbers of employment published by the federal governments of the United States and Canada and by several of the state governments and city agencies, and the Federal Reserve Board in the United States, was begun

in the summer of 1928. Inquiries had been received from state officials as to how they should proceed to improve their indexes, and several expressed the hope that a more uniform procedure could be agreed upon. The Committee secured the assistance of Miss Miriam E. West, of Rutgers College, who prepared a report representing a thorough analysis and testing of results of the existing index numbers, for submission to the Committee at its meeting in Chicago in December, 1928. There has been a good demand for the report. Mimeographed copies are available at $1.00 per copy.

At the annual meeting in 1928 the report was endorsed by the Committee, and its principal findings were accepted by practically unanimous vote. The Committee agreed to accept the principle of a multiple-year base and that the base period should be 1925–27. The Industrial Commission of Illinois, the Department of Labor and Industries of Massachusetts and the Department of Labor of the State of New York have undertaken the reorganization of their employment indexes on these lines. The Federal Reserve Board now prefers the base 1923–25, in accordance with the practice for index numbers adopted by the Board in 1926, but it is hoped that the Board and the Committee will shortly be able to agree on the same base period. The United States Bureau of Labor Statistics is using the year 1926 as a base.

(2) *Index of Public Employment*

With the support of the Welfare Council of New York City, the Committee has begun work on an index of employment afforded by the New York City government. It was discovered that the records nowhere indicated the number of employees covered by the various payrolls, and in order to avoid the laborious task of counting the names each month the city government issued orders that the number of employees should be reported on each payroll. As an experiment in procedure, the posting and tabulating of the numbers of employees and earnings for the 2,000 payrolls have been completed for two months. It is hoped that a regular system of reporting the employment and earnings of the employees of the New York City government will shortly be instituted. The Committee is now addressing itself to the work of measuring the employment afforded by the City through contractors.

(3) *Unemployment Questions in the Federal Census*

In view of the lack of data necessary for a careful estimate of the extent of unemployment, the Committee has sought the inclusion of questions on unemployment in the 1930 census of population. A subcommittee, with Dr. E. B. Patton as chairman, was appointed at the annual meeting held in Chicago in December, 1928, to undertake the difficult technical task of formulating questions. The subcommittee drafted the following recommendations:

> *Definition of unemployment.* Loss of salary or wages during the week preceding the enumerator's call by persons able and willing to work full time but unable to find full-time employment. Persons "entirely unemployed" are those of this class who have no jobs because of bad weather, slack work or emergency conditions. Persons partially unemployed are those with jobs who had no pay or part pay during the week for the same reasons.

Census Questions

(1) Employer, wage or salary worker, or working on own account?
(2) If person is usually employed for others, is the occupation regularly on a *part-time basis?*
(No further questions to be asked of part-time workers.)
(3) If person is usually employed for others on a *full-time basis*, did he receive or will he receive for the week ended last Saturday (a) a full week's pay or more, (b) no pay because he did not have a job of any kind, (c) no pay for other reasons, (d) part of a week's pay?
(4) If person received or will receive no pay or part of a week's pay, was the cause
(a) Illness or accident.
(b) Vacations, holidays, or other personal reasons.
(c) Strike or lockout.
(d) Fire, flood, or other such emergencies.
(e) Lack of work due to weather.
(f) Slack work.
(g) Other circumstances.

Question 1. The term "unemployed" can be properly applied only to persons who ordinarily work for others. Certainly unemployment among self-employed persons, if the possibility of such condition be accepted, cannot be measured. It would seem advisable to provide in the instructions to the enumerator that persons holding responsible positions, such as executives of corporations, shall be accepted as employed without detailed inquiry.

Question 2. Among those who work for others there are a number who do not want full employment, such as part-time waitresses and part-time salespeople. It would be impossible to measure unemployment among such persons, and in any case such unemployment would not constitute a serious social problem. Certainly the part-time typist who has lost her job should not be counted as unemployed on the same basis as the molder who has been released from the foundry. Persons who usually work on a part-time basis should be excluded from the inquiry.

Question 3. Unemployment from industrial causes takes a number of forms: (a) complete release from a job; and (b) part-time separation from a job, which may be in the form of entire layoff for a period of days or weeks, or of part-time unemployment during the day. The employee who is on layoff for half the week through shutdown of his factory is in the same position from the standpoint of earnings as the worker who works half a day each day throughout the week. Whether the unemployment shall be in the one form or the other depends mainly on the nature of the business. A plant manufacturing ice cream receives orders daily for immediate delivery, and during the off season it must have some workers in the plant to meet the demand. The management may think it the fairest practice to work part time each day so that all employees will share equally in the reduced employment available; or it may employ half of the force fully one week and the other half the next week, on the system of rotation layoff. It cannot close down the plant. On the other hand, a firm that manufactures goods that can be stored may shut down entirely during the slack season, giving the employees opportunity to secure temporary employment until recalled, or it may work a few days each week. These are different forms of unemployment, and if any one of them is excluded from the census the enumeration will be incomplete.

Questions directed to ascertaining complete unemployment on a single day will ignore a great deal of unemployment in forms that are quite as serious. If the week is taken as the unit of measurement rather than the day, complete layoff for the week, part-time unemployment daily throughout the week, and a number of days of unemployment in the week—in short, unemployment in all its forms—can be covered.

There is a common measure for all these forms of unemployment—loss of wages—and it is submitted that if the inquiry is to cover unemployment in all its forms this measure must be used. It would seem impracticable to ask the amount of unemployment in the week in terms of time lost, since the worker might have lost time but received pay. This difficulty can be overcome by ascertaining whether the employee received or will receive a full week's pay or

more, part of a week's pay, or no pay for the week. With those who received or will receive a full week's pay or more excluded, the remainder constitute the three classes of unemployed: (a) those entirely unemployed during the week because they had no jobs, (b) those who held jobs but received no pay for the week and (c) those who held jobs but received part pay for the week. This form of inquiry meets another difficulty—that connected with the worker, such as the railroad porter who is at home between trips. The rest period being a normal occurrence, he would inform the enumerator that he had earned the full pay for the week. On the other hand, if the question were asked, "Does he lose a day's pay by not being at work?" he would probably say "Yes," thus unfairly counting himself as unemployed. This kind of inquiry would also effectively deal with persons not actually working on account of vacation, sickness, et cetera, but drawing pay.

Question 4. When the three groups of unemployed have been segregated by Question 3, the question arises as to whether they are unemployed in the industrial sense or for personal or other reasons. It must be discovered concerning class (a), those entirely unemployed during the week because they had no jobs, whether they lost their jobs for industrial or other reasons. Similarly for class (b), those who held jobs but were entirely unemployed during the week, it must be indicated whether the week's unemployment was due to industrial or other reasons. Again for class (c), those who held jobs but were partially unemployed during the week, the cause of the loss of time must be indicated.

The main personal causes of unemployment are illness or accident, vacations, holidays, or other personal reasons. In addition, there are a number of minor considerations which the person will give as a cause and for which provision must be made in the inquiry. The chief industrial and non-personal causes are fire, flood or other such emergencies, lack of work due to weather, slack work, and industrial disputes. The last must be set apart in a separate category, since either the management or the employees or both parties may be responsible.

Question 1 will yield the number of wage or salary workers—in short the entire group—exposed to unemployment.

From Question 2 will be derived the number of persons who ordinarily work part time by choice and for whom unemployment is not to be considered. The number of this group should be deducted from the total exposure secured in Question 1, to give the group to be covered by the inquiry.

If Question 3 is asked of all those ordinarily employed on a full-time basis, as discovered through Questions 1 and 2, three classes of unemployed or underemployed are segregated:

(a) Those who had no pay because not attached to jobs.
(b) Those who had no pay for other reasons.
(c) Those who received part of a week's pay.

When Question 4 is asked of all persons in group (a), there will be derived

(a) The number entirely unemployed but not within the terms of the definition (4a, 4b, 4c, 4g).
(b) Those entirely unemployed within the terms of the definition (4d, 4e, 4f).

When Question 4 is asked of group (b), there will be derived

(a) Those out of work all week but not within the terms of the definition (4a, 4b, 4c, 4g).
(b) Those out of work all week but within the definition (4d, 4e, 4f).

When Question 4 is asked of group (c), there will be derived

(a) Those who lost some time and were not within the definition (4a, 4b, 4c, 4g).
(b) Those who lost some time but were within the definition (4d, 4e, 4f).

Although a number of the questions on the census schedule as finally adopted are similar to those suggested, the final census schedule seems at fault in a number of particulars. The fundamental defect lies in the partial definition of unemployment. According to the census plan, only persons who for non-personal

reasons did not have any work on the day before the enumerator's call will be considered as unemployed. This means that there will be no attempt to cover unemployment due to part-time work either within the day or within the week. In accordance with the Committee's definition, all persons receiving no pay or part pay during the week because of lack of work would be grouped as entirely unemployed or partially unemployed. The Committee is unable to agree with the inclusion of self-employed persons and those whose occupations are regularly on a part-time basis. The Committee feels that, since unemployment among such persons cannot be determined and, in connection with the second group at any rate, does not constitute a great social problem, such persons should be excluded from the inquiry.

(4) *Collection of Monthly Statistics of Employment and Earnings in the Biennial Census of Manufactures*

The Director of the Census has announced that, although the inquiry for employment statistics by months had been made for every industry, for the census of manufactures of 1927, owing to the necessity of curtailing the work so that adequate preparations might be made for the coming decennial census, the Census Bureau had planned to *tabulate* these statistics by months for 12 industries only. These 12 industries together accounted for 3.1 per cent of the total number of establishments and 19.3 per cent of the total number of wage-earners reported at the census of 1925.

The labor statisticians of the country have found the census data on employment a sole indispensable check on the sampling method used in their own collection of employment data, and they also have been handicapped by the lack of any inquiry in the census concerning the monthly earnings of employees.

At the Committee's direction the matter was again discussed with the census officials in Washington. The tabulation of monthly employment statistics in the census of 1927 was definitely limited to 13 industries (one more than previously announced). But the Director of the Census informed the Committee that in the census of manufactures for 1929 and 1931 the inquiry in regard to the number of wage-earners employed on the fifteenth of each month or nearest representative day would be retained on the schedule and if practicable the monthly employment figures would be tabulated for all industries. In any event, after the close of the fifteenth census period the publication of the monthly employment figures would be resumed.

The Committee has been negotiating with the Census Bureau with a view to the collection of data on monthly earnings; but, as above indicated, no practical results have been obtained.

(5) *Collection of Man Hours Data in the Census of Manufactures*

The Committee and other agencies have been urging the collection of data on man hours in the census of manufactures. The Bureau of the Census has agreed to gather data on man hours for the year 1929, for the following industries: blast furnaces; lumber and timber products (limited to establishments reporting products valued at $1,000,000 or more); machine tools; petroleum refining.

(6) *Collection of Monthly Statistics of Employment and Earnings in the Census of Distribution*

The Committee has been advocating inquiries for monthly data on employment and earnings in the census of distribution, with the results above indicated.

(7) *Employment Statistics of the New Jersey Bureau of Labor*

The Committee has given some assistance to the New Jersey Bureau of Labor in improving its employment statistics. The list of representative firms needed revision, and the intermonth and yearly comparisons were not based on identical firms. The index numbers as recently published show marked improvement.

(8) *Employment Office Statistics*

With a view to an inquiry on the statistical methods of public employment offices, some work has been done on the preparation of a bibliography.

(9) *History of Data on Employment and Earnings in the United States Census of Manufactures*

The Committee has under way a survey of the labor statistics, monthly and annual, which have appeared in the reports of the United States censuses of manufactures since 1890, as a basis for the better determination of the Committee's needs for labor data from that source.

(10) *Developments in Labor Statistics*

There have been several important developments in labor statistics during the year. In April, 1928, Senator Wagner introduced a bill proposing an amendment, prepared by the Committee to the United States Department of Labor Act, to extend the collection of employment statistics to industries other than manufacturing. Although the bill was not passed, the government acted on its proposals. The necessary funds were provided and the Bureau of Labor Statistics extended the scope of its employment data. In August, 1928, wholesale and retail trade were encompassed, and before the close of the year certain public utilities, anthracite and bituminous coal-mining, metalliferous mining and hotels were added. The reports for May, 1929, were further extended to include canning and preserving, and for June to include quarrying and non-metallic mining.

With June, 1929, the Bureau began its first current monthly report on labor turnover in manufacturing industries. These data had been collected and compiled for several years by the Metropolitan Life Insurance Company under the direction of Dr. W. A. Berridge; the figures had been forwarded to the Bureau of Labor Statistics and published quarterly in the *Monthly Labor Review*. The project was transferred to the Bureau in midsummer, 1929. Feeling that labor turnover data for "all industries" was not a satisfactory yardstick, the Bureau began work on the data for separate industries. In the coming year the publication of indexes for three industries, automobiles, iron and steel, and boots and shoes, will be begun and indexes for cotton textiles and lumber will also be developed.

An unemployment census was taken in Buffalo during the first week of November, through the coöperation of the New York State Department of Labor, State Teachers College of Buffalo, University of Buffalo, Canisius College and

the Buffalo Foundation. Information was secured through a house-to-house canvass made by college students. Fifteen thousand one hundred and sixty-four persons were included in the study, and of that number 1,509 or 9.9 per cent were unemployed, 981 or 6.5 per cent had only part-time work and 12,674 or 83.6 per cent had full-time employment. It is hoped that the Buffalo study may be repeated at the same season of the year for a series of years, and that similar studies may be made in other cities with the coöperation of the universities.

In the United States Bureau of Mines attention has been directed to the perfecting of accident statistics through the improvement of reports on man hours. It is recognized that the present rates are subject to error and that more accurate man-hour data are required in order to establish a better annual base.

(11) *Program of the Committee for 1930*

The Committee is planning a study of the statistics of public employment offices with a view to the development of a statistical procedure that would commend itself to state bureaus of labor and the United States Employment Service. The International Association of Public Employment Services, at its seventeenth annual convention, held in Philadelphia, September 24–27, 1929, voted to request the Committee to undertake such a project.

In view of the meagre statistical experience of employment offices in the United States, the study will involve examination of the methods worked out after long experiment by the employment exchanges of the principal European countries. During the Executive Secretary's absence in Europe in connection with the study, Dr. E. B. Patton will act as Secretary of the Committee.

The plans of the Committee for 1930 include also a survey of wage statistics in the United States, with a general view to securing improvement and uniformity in the collection of these data. Mr. Roswell F. Phelps will have the work in charge, with the assistance of a committee.

The membership of the Committee during the past year has been as follows:

A. J. Altmeyer, Wisconsin Industrial Commission
Charles E. Baldwin, United States Bureau of Labor Statistics
Joseph A. Becker, United States Department of Agriculture
William A. Berridge, Metropolitan Life Insurance Company
Louis Bloch, California Bureau of Labor Statistics
R. D. Cahn, Chicago Tribune
R. H. Coats, Dominion Bureau of Statistics, Canada
J. Frederic Dewhurst, Federal Reserve Bank of Philadelphia
Paul H. Douglas, University of Chicago
Leonard W. Hatch, New York State Department of Labor
Ralph G. Hurlin, Russell Sage Foundation
Richard Lansburgh, University of Pennsylvania
Don D. Lescohier, University of Wisconsin
Leifur Magnusson, Washington Branch, International Labor Office
Eugene B. Patton, New York State Department of Labor
Roswell F. Phelps, Massachusetts Department of Labor and Industries
Harold V. Roelse, Federal Reserve Bank of New York
Bryce M. Stewart, Industrial Relations Counselors, Inc. (Executive Secretary)
F. G. Tryon, United States Bureau of Mines
Mary van Kleeck, Russell Sage Foundation (Chairman)
H. H. Ward, Deputy Minister of Labour, Canada
Ralph J. Watkins, National Bureau of Economic Research
Sidney W. Wilcox, University of Pittsburgh

Ada M. Matthews has served as full-time assistant to the Executive Secretary. The Committee has had office space in the Department of Industrial Studies of the Russell Sage Foundation, and the expenses of its work have been paid through the budget of that Department.

Respectfully submitted,

MARY VAN KLEECK, *Chairman*
BRYCE M. STEWART, *Executive Secretary*

Report of Joint Advisory Committee to the Director of the Census

The Joint Advisory Committee of the American Statistical Association and the American Economic Association to the Director of the Census held two meetings during 1929, the first on April 13, the second on October 18 and 19.

At the earlier meeting the following minute about the deaths of W. S. Rossiter and Allyn A. Young was entered on the record and sent to the widows of the deceased members:

> The Census Advisory Committee hereby records its sense of irreparable loss in the death since its last meeting of W. S. Rossiter and A. A. Young.
>
> The original organization of the Committee was due more to Rossiter than to any other man. He realized that it might be useful, laid the plans before a few associates who joined with him in persuading both the Secretary of Commerce and the two coöperating societies to experiment in this untried field. He was the Chairman of the Committee from that time till his death and what success it has had is due more to his knowledge of census work, his tact, sound judgment, and energy than to any other cause.
>
> Young was also a member of the Committee from the start and so long as his work lay on this side of the Atlantic. His broad knowledge of statistical problems, his early familiarity with census work, and his insight and sound judgment led the Committee to rely on him probably more than on any other member in dealing with difficult problems of census technique. The work of the Committee during the past ten years is a memorial of their disinterested labors.

That meeting was called by the Director at the suggestion of Senator Arthur H. Vandenberg, who desired to get the Committee's opinion about the pending apportionment bill. After much discussion the following letter to the Director was approved by all the members present and a copy forwarded at once to Senator Vandenberg:

DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS
WASHINGTON

April 13, 1929

HON. WILLIAM M. STEUART,
Director of the Census,
Washington, D. C.

Sir:

In compliance with Senator Vandenberg's request as transmitted to us through the Director of the Census, we have given consideration to the question of what method of apportionment should be prescribed in a law providing for a ministerial apportionment to go into effect following each decennial census in case Congress itself fails to act.

Independently of the relative merits of different methods of apportionment we are of the opinion that in a law providing for ministerial apportionment of representatives to go into effect only in case Congress itself fails to make an apportionment it is desirable to provide that the method shall be that "followed at the last preceding reapportionment," since presumably the intent of Congress would be

best carried out by this procedure. This would leave it open to future Congresses to apply or prescribe whatever method may be approved and would avoid what might otherwise prove to be temporary definitions in a law aiming at permanence.

The Committee ventures to express the hope that the present Congress not only will pass a general and permanent enabling act as indicated, but also will appoint a special committee or commission to study the subject of methods of apportionment in all its phases and to prepare a comprehensive report for the information of Congress in connection with the specific apportionment of 1930. In this connection it may be proper to call attention to a report submitted by the Census Advisory Committee to Senator Sutherland under date of February twenty-four, nineteen hundred and twenty-one.

Respectfully submitted,

The Census Advisory Committee:

WALTER F. WILLCOX, *Chairman*
GEORGE E. BARNETT
ROBERT E. CHADDOCK
WILLFORD I. KING
G. F. WARREN

The opinion thus expressed was also endorsed individually by Professor C. W. Doten, Professor W. C. Mitchell and Professor E. R. A. Seligman, three of the four living members of the Committee who had signed its report to Senator Sutherland in 1921.

Senator Vandenberg has expressed his appreciation of the Committee's services in this matter by the following letter to the Chairman:

UNITED STATES SENATE

January 6, 1930

PROFESSOR WALTER F. WILLCOX,
Chairman, Census Advisory Committee,
Cornell University,
Ithaca, New York.

My dear Professor Willcox:

Your Committee has rendered indispensable service in connection with the new reapportionment law which fixes a permanent and automatic routine under which there can be no further lapses in this decennial constitutional function.

In the midst of my preparation for the battle over this legislation in the Senate, I confronted the absolute necessity for unifying the scientific thought of the country—so far as possible—upon one advisable method of procedure. The most effectual encouragement enjoyed by the opponents of reapportionment came from what seemed to be a violent disagreement among the country's experts as to the best reapportionment method. The disagreement in fact related to a mathematical formula and not to the desirability of an automatic rule of procedure which should permanently cure the nullification of a decade. My problem was to make this distinction unassailably plain to the Senate. In this extremity I appealed to Dr. Steuart, Director of the Census, to reassemble his Advisory Committee drawn from the membership of the American Statistical Association and the American Economic Association. Secretary of Commerce Lamont concurred in my request. Thereupon your Committee assembled in Washington and made its now famous report of April 13, 1929. In this report your members took the large and necessary view that a quarrel over mathematical detail should not be permitted to defeat the major constitutional need for automatic decennial reapportionment as the Constitution directs. Your unanimous report in favor of the permanent enabling act was the most powerful single weapon in my hands throughout the contest which resulted in writing this enabling act into the law of the land.

Your Committee is entitled to feel that it substantially shares whatever credit may attach to this congressional action which has cured the nullification of a

decade and which promises immunity from such nullification for the future. I renew my expression of deep appreciation for the very splendid coöperation rendered in this emergency.

Cordially and faithfully,

A. H. VANDENBERG

The meeting in October was devoted mainly to discussion of the plans for the population census of 1930. During that meeting the following resolutions were adopted about the schedule for that census:

RESOLVED, that the Advisory Committee is not in favor of adding to the population schedule a question in regard to crippled children.

RESOLVED, that the Advisory Committee approves the special schedule on unemployment as prepared by the Bureau to supplement the population schedule.

RESOLVED, that the Advisory Committee is not in favor of restoring to the population schedule the question about the mother tongue of the foreign-born parents of the population, either native or foreign born.

RESOLVED, that the Advisory Committee recommends that Column 8 which now reads: "If owned, free or mortgaged," be changed to read as follows: "Value of home if owned, or monthly rental if rented."

RESOLVED, that the Advisory Committee is in favor of adding to the population schedule the question, "Age at first marriage" in order to get in a simple way information of fundamental importance in connection with the proposed family card.

RESOLVED, that the Advisory Committee is in favor of asking about all married women in not more than one-tenth of the supervisors' districts the questions:

Number of children born
Number of these children living
Age at first marriage
Whether first or later marriage

in order to get light upon the fertility of marriage in different population classes and to test sampling methods in this field.

W. F. WILLCOX, *Chairman*

Report of Committee on Institutional Statistics

The Committee on Institutional Statistics has held no meetings during the current year, but has continued through its secretary, its negotiations with the Social Science Research Council in an effort to secure adequate financing of the Committee's work. The application for funds originally made by the Committee to the Social Science Research Council in July, 1928, was not finally acted upon until early in the present year, the Committee's request having been referred to the Committee on Population of the Social Science Research Council, which later acted adversely to such request.

It was the feeling of the members of the Committee on Institutional Statistics that the reference of its request to the Committee on Population of the Social Science Research Council did not imply full understanding of the Committee's proposals by the governing body of the former agency. Accordingly, an effort to reopen the matter was made and the Social Science Research Council was requested to review the proposals of the Committee on Institutional Statistics at its annual meeting in August of this year. This the Social Science Research Council did and the secretary of the Committee on Institutional Statistics was notified in September last that a special committee of the Council had been appointed to consider not only the proposals of the Committee on Institutional Statistics, but all other proposals and activities in the field of social statistics

with the view to integrating and coördinating these activities, and to take such further action in the matter as it should deem necessary.

The Special Committee on Social Statistics thus appointed comprises Shelby Harrison, *Chairman*, Russell Sage Foundation; Luther H. Gulick, National Institute of Public Administration; Ralph Hurlin, Russell Sage Foundation; William F. Ogburn, University of Chicago; A. W. McMillen, University of Chicago; and Horatio M. Pollock, New York State Department of Mental Hygiene. It will be the function of this Committee to deal with the entire problem of social statistics during the coming year. Further action by the Committee on Institutional Statistics in this matter will, therefore, be held in abeyance until the Special Committee above referred to has made its report.

Your Committee is pleased to report that the Federal Census Bureau has issued the first of its annual statistical reports relating to the state institutions for the insane, feebleminded, epileptic and delinquent classes. These reports mark a distinct advance in nation-wide statistics of these institutions, as previous reports in this field had been issued by the Bureau at intervals varying from six to fourteen years.

In order to insure continuance of the present policy of the Census Bureau in the compilation of institutional statistics, your Committee, with the approval of the Bureau, and in coöperation with committees of other national organizations, secured the introduction in Congress of a bill giving the Census Bureau specific authority to collect and publish annually statistics relating to the mentally-diseased, defective, epileptic and delinquent classes. It is hoped that the measure may be passed during the present session of Congress.

Progress in social statistics in general and in institutional statistics in particular seems unnecessarily slow. Slight gains are recorded from year to year, but we are still a long distance from the desired goal. Without funds our Committee can do but little; but if adequate means are provided by the Social Science Research Council, we believe that new impetus may be given to this important movement.

Respectfully submitted

Carl E. McCombs, *Secretary*	Neil A. Dayton
Horatio M. Pollock, *Chairman*	Neva R. Deardorff
Frederick Bane	Emil Frankel
Frederick W. Brown	Edith M. Furbush
Kate H. Claghorn	Joseph A. Hill

Benjamin Malzberg

Report of the Committee on the Encyclopedia of the Social Sciences

The annual meeting of the Joint Committee has been postponed until January and your representatives have not been called upon during the year for any work in connection with the Encyclopaedia. Fine progress has been made by the editors. The first volume is to appear in January and thereafter it is expected that succeeding volumes will be issued at the rate of three a year for a period of five years.

Respectfully submitted

R. H. Coats
Mary van Kleeck

Report of Committee on Social Statistics

The Committee has taken as its present field of work an examination of the place of statistical method in social and sociological inquiry. We propose, during the coming year, to consider some of the underlying problems of method which are raised when the statistical method is introduced into sociology. As a preliminary aspect of this task, the Committee arranged for the present annual meeting a series of papers designed to portray the extent to which statistical method has already been applied or foreshadowed in a number of specific social and sociological fields. These were as follows: dependency, crime and police administration, the family and marriage, health and medical care, the enforcement and social effects of prohibition, personality and mental adjustment, and social attitudes and public opinion.

During the year the Committee has given attention to the plans of the United States Census Bureau with respect to the preparation of a family schedule for the 1930 enumeration. Without infringing upon the work of other advisory committees, its coöperation has been extended to the Census Bureau, has been welcomed by the latter, and will be continued under the direction of a sub-committee of which Dr. Neva Deardorff is chairman.

We have also concerned ourselves with the extent to which various groups of specialists in fields of subject matter which utilize statistical procedures are represented in the membership of the American Statistical Association, with a view to determining the scope of the Committee's liaison functions between statistics and sociology. Among 1,787 members of the American Statistical Association, we have been able to identify affiliations with other scientific organizations in the case of 727 members. We have discovered for these 727 members, 1,000 other affiliations. These are in part as follows, duplications not being eliminated, and the field of interest only being named: Economics, 500; Sociology, 74; Political science, 30; Mathematics, 95; Actuarial science, 63; Physical science (physics, chemistry, astronomy, geology, geography), 10; Biological science (zoölogy, botany), 7; Anthropology, 10; Psychology, 23; Engineering, 11; Medicine, 9; Education, 17. As indexes of interest, these figures are probably too small in the case of the last 7 items, nor can they be used comparatively apart from their context, which will be submitted to the JOURNAL as a note. They do indicate *roughly* the extent to which various interests are represented within our membership, and they suggest something of the task confronting this Committee in developing sociological statistics within what is clearly, in essence, an *economics and business statistical association.*

The Committee, as now constituted, consists of nine members. It here recommends its own continuation. If this be granted, it is proposed to recommend additional members to the Executive Committee.

Respectfully submitted

STUART A. RICE, *Chairman*

WILLIAM A. BERRIDGE
F. STUART CHAPIN
NEVA R. DEARDORFF
EMIL FRANKEL
RALPH G. HURLIN
MAURICE J. KARPF
PHILIP KLEIN
EMMA A. WINSLOW

COMMITTEES FOR 1930

Committee on Honorary Members

Edmund E. Day, *Chairman*
Robert E. Chaddock
E. Dana Durand
Carl Snyder
Walter W. Stewart
Edwin B. Wilson

Committee on the Social Science Research Council

Edwin B. Wilson ..... Term expires December 31, 1930
Edmund E. Day ..... " " " " 1931
Wesley C. Mitchell ..... " " " " 1932

Committee on Fellows

Robert E. Chaddock ..... Term expires December 31, 1930
Horace Secrist ..... " " " " 1931
Joseph E. Pogue ..... " " " " 1932
Edgar Sydenstricker ..... " " " " 1933
Seymour L. Andrew ..... " " " " 1934

Advisory Committee on the Census

Willford I. King ..... Term expires December 31, 1930
L. D. H. Weld ..... " " " " 1931
Robert E. Chaddock ..... " " " " 1932

Committee on Finance

Edmond E. Lincoln, *Chairman*
Leonard P. Ayres
Frederick R. Macaulay

Committee on Institutional Statistics

Horatio M. Pollock, *Chairman*
Frank Bane
Frederick W. Brown
Kate H. Claghorn
Neil A. Dayton
Neva R. Deardorff
Emil Frankel
Edith M. Furbush
Carl E. McCombs
Benjamin Malzberg
Bennet Mead

Joint Committee on Standards for Graphics

Karl G. Karsten, *Chairman*
Frederick E. Croxton
Irving Fisher
Arthur H. Richardson

Committee on Governmental Labor Statistics

Mary Van Kleeck, *Chairman*
Eugene B. Patton, *Secretary*
Charles E. Baldwin
Joseph A. Becker
W. A. Berridge
Louis Bloch
R. D. Cahn
R. H. Coats
J. Frederic Dewhurst
Paul H. Douglas
O. A. Fried
Leonard W. Hatch
Ralph G. Hurlin
Don D. Lescohier
Leifur Magnusson
Howard B. Myers
Roswell F. Phelps
Casimir A. Sienkiewicz
Bryce M. Stewart
F. G. Tryon
H. H. Ward

Representative on the Board of Directors of the Encyclopaedia of the Social Sciences

Wesley C. Mitchell

Representative on the Advisory Board of the American Year Book

Edwin W. Kopf

Joint Committee on the Encyclopaedia of the Social Sciences

Mary Van Kleeck, *Chairman*
R. H. Coats

Nominating Committee

Edwin B. Wilson, *Chairman*
E. Dana Durand
Carl Snyder

Representative on the Joint Committee for the Development of Statistical Applications in Engineering and Manufacturing

Walter A. Shewhart

Representative on the Business Research Council

Donald R. Belcher

Committee on Price Statistics

Carl Snyder, *Chairman*
Willford I. King
Morris A. Copeland, *Secretary*
Frederick C. Mills
Robert W. Burgess
Wesley C. Mitchell
Mordecai Ezekiel
Warren M. Persons
Irving Fisher
Edwin B. Wilson
Holbrook Working

Advertising Committee

L. D. H. Weld, *Chairman*
Willford I. King
Edwin W. Kopf